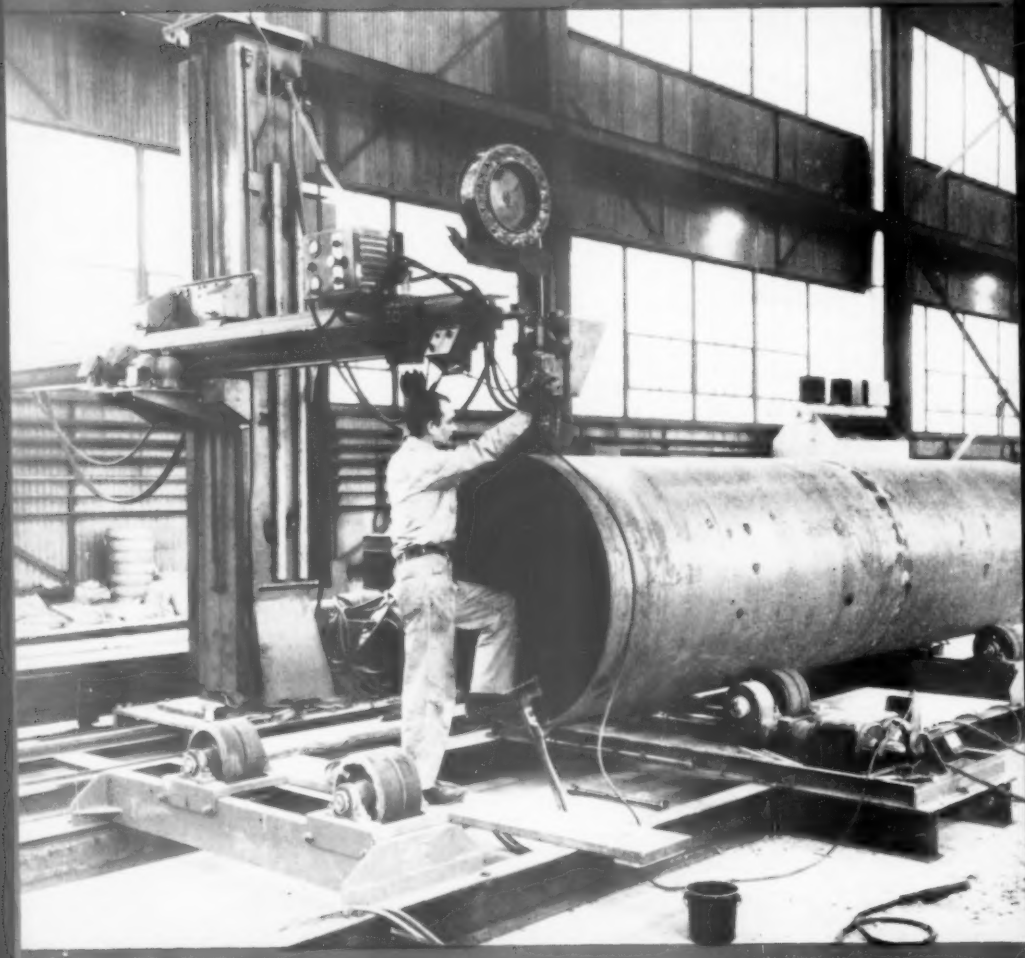
MARCH, 1954

Industry & Welding



FRANCHISE CIRCULATION

Use of ram-type fixture speeds automatic submerged arc welding at Lackawanna Steel Construction Corp., Buffalo, N. Y. Complete article on rebuilding worn equipment with automatic welding starts on Page 37.

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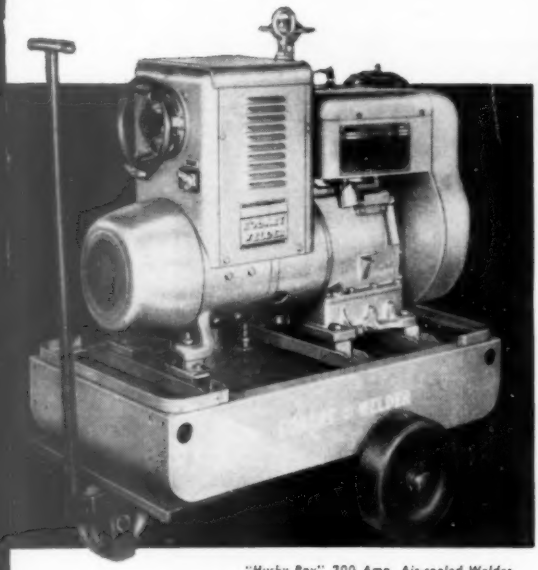
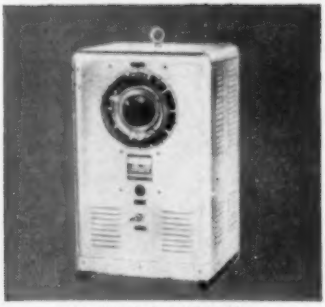
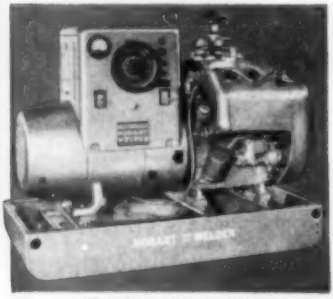


"Husky Boy" 200 Amp. Air-cooled Welder



Transformer Type AC Welder



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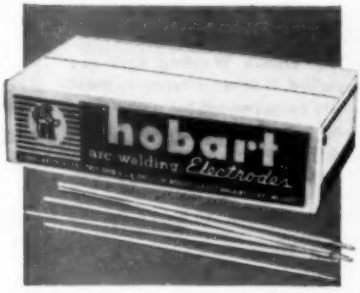

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TITAN Bronze Welding Rods are supplied in several types to meet every requirement for oxy-acetylene welding. All are carefully deoxidized to assure ductile, high-strength, non-porous welds. Our general purpose rods are Double-Deoxidized by a patented process.

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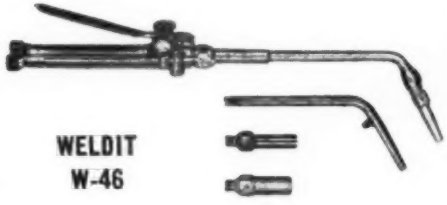
Weldit Model W46T Weldimatic Twin-Tip Torch designed for tube brazing enables operator to apply flame to opposite sides of work at the same time.



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Industry & Welding

MARCH, 1954
VOL. 27 No. 3

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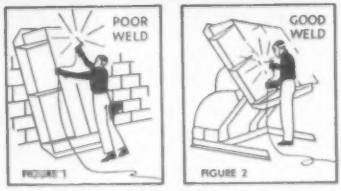
A way to get more and better welding from your welders

Every minute your welders spend climbing, turning and propping is *lost* welding time.

Turn this waste time into *all arc-time* with Worthington Welding Positioners that tilt or turn all welds into position—*without delay*—for *continuous* downhand automatic or manual welding. Today's labor scarcity makes this increased production more important than ever.

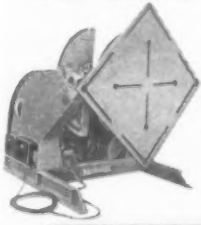
These Positioners lower costs and boost production up to 50%. Downhand welding is *quicker* (only one pass instead of two or three) . . . *better* (deeper penetration with higher current, heavier electrodes, faster deposition of weld metal) . . . *neater* (weld metal levels itself). There's less rod waste, too.

Where can you see a Worthington Welding Positioner at work near you? Just write Worthington Corporation, Positioning Equipment Division, Plainfield, N. J., for this information or for Bulletin 210D.



HOW WORTHINGTON WELDING POSITIONERS PRODUCE BETTER WELDS

When the welder has to climb over, prop or flop the work-piece, he may only be able to use downhand welding over a limited area (Figure 1). With a Worthington Welding Positioner, the work is continually tilted or rotated automatically into position for downhand welding (Figure 2).



WORTHINGTON'S UNIVERSAL TABLE TOP makes the Welding Positioner as profitable on job work as mass production. Those "T" slots make the table adaptable to any shape of work-piece and a wide range of sizes. No special jigs or fixtures needed.

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Literature Featured In Ads This Month

(CIRCLE ON ENCLOSED POSTCARD NUMBERS OF LITERATURE YOU WISH TO RECEIVE)

1 **Electrode holders** with interchangeable tip insulators are featured in literature offered by TWECO PRODUCTS CO. Inside Front Cover.

2 **"How To Get Better Welds"** is the title of a new booklet offered by HOBART BROS. CO. Page 1.

3 **Bronze welding rods** for repair and production welding are covered in booklet. TITAN METAL MFG. CO. Page 2.

5 **Resistance welding accessories** suited for every function are headlined in a new booklet offered by WW ALLOYS, INC. Page 4.

6 **New line of welding helmets,** lightweight and heat resistant are featured in new catalog. WILLSON PRODUCTS, INC. Page 6.

8 **Welding positioners** for convenience and economy are featured in new literature. WORTHINGTON CORP. Page 8.

9 **Pneumatic tools** for faster weld removal are featured in literature offered by the MASTER PNEUMATIC TOOL, INC. Page 12.

12 **Toggle clamps** available in 35 different sizes are headlined in new catalog offered by WEST POINT MFG. CO. Page 14.

15 **Gas seals** for oxy-acetylene torches are given coverage in literature now available from LINDE AIR PRODUCTS CO. Page 17.

16 **First prize, $500.** Rules for essay contest on positioned welding are now available from PANDJIRIS WELDMENT CO. Page 19.

18 **Resistance welding catalog** complete with data on all accessories and equipment is now available from P. R. MALLORY & CO., INC. Page 21.

19 **For the latest tips** on welding write for Publication B-13 now available from the AMERICAN BRASS CO. Page 22-23.

22 **Spectacle type safety goggles** for complete eye protection are featured in literature. PENNSYLVANIA OPTICAL CO. Page 27.

23 **Lightweight automatic welders** with AC-DC control are featured in literature. SIGHT FEED GENERATOR CO. Page 28.

24 **Welding positioners** available in capacities up to 30,000 lbs. are featured in literature now available from CULLEN-FRIESTEDT CO. Page 29.

30 **DC rectifier welders** efficient in operation and low in maintenance cost are featured in literature. A. O. SMITH CORP. Page 36.

32 **Rectifier welders** with new design features for added welding performance are featured in literature. WESTINGHOUSE ELECTRIC CORP. Page 42-43.

34 **Welding and cutting equipment** for every oxy-acetylene need is featured in new catalog. NATIONAL CYLINDER GAS CO. Page 48-49.

35 **Hard facing alloys** for longer service and less down time are covered in literature. THE STOODY CO. Page 53.

36 **Manual of welding** engineering and design is now available from the EUTECTIC WELDING ALLOYS CORP. Page 55.

37 **Abrasive products** for weld grinding and blending as well as many other uses are covered in new catalog. CARBORUNDUM CO. Page 56-57.

38 **New electrodes** which cut cost and speed-up welding are covered in Bulletin 481. LINCOLN ELECTRIC CO. Page 63.

39 **Welding, brazing, soldering,** tinning and cutting booklets are now being offered by the ALL-STATE WELDING ALLOYS CO., INC. Page 64.

Did you know that *Aronson* makes the best HEAD and TAIL STOCKS?

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Capacity 5000 Lbs.

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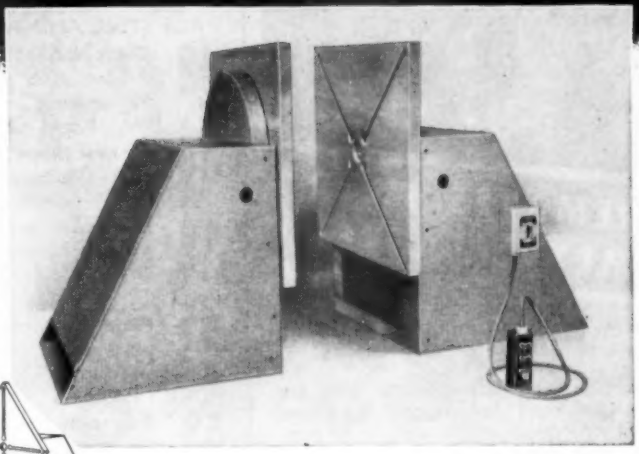
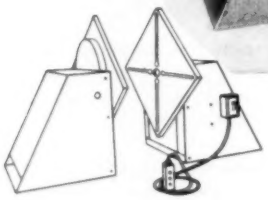
OTHER MODELS WITH CAPACITIES of 12,000 Lbs. and 32,000 Lbs.





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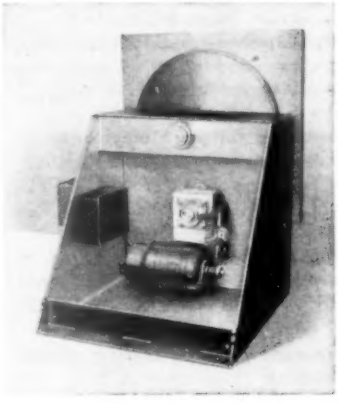

Back view showing clean design and simple construction of internal mechanism.

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Horizontal Grinders

Write for literature available on all models and sizes.

MASTER PNEUMATIC TOOL COMPANY, INC.
Orwell, Ohio

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40 **Flame cutting machines** for every cutting operation are featured in new bulletin. OHMSTEDE MACHINE WORKS. Page 66.

42 **Automatic welding wire** for inert gas and submerged arc welding is given wide coverage in literature. PAGE STEEL AND WIRE DIV. Page 69.

43 **Cable connectors** "almost as efficient as a solid piece of copper" are covered in brochure. CAMLOK DIV. Page 70.

46 **A new hard facing manual** is now available from the WALL COLMONOY CORP. Page 76.

48 **Resistance welding electrodes** for more welds per electrode are featured in literature. TIPALOY, INC. Page 80.

52 **Plate bending rolls** in a complete range of sizes and models are covered in new catalog. THE WEBB CORP. Page 85.

53 **Two aids for welding** operators for easier, more efficient welding are covered in literature. MULLENBACH ELECTRICAL MFG. CO. Page 86.

54 **Complete outfit** for medium and light welding operations is covered in booklet. MODERN ENGINEERING CO., INC. Page 87.

56 **High speed grinding,** polishing, sanding and cutting machines are covered in booklet. THE NEDCO CO. Page 88.

59 **Packaged tungsten electrodes** for money saving welding applications are covered in literature. SYLVANIA ELECTRIC PRODUCTS CORP. Page 90.

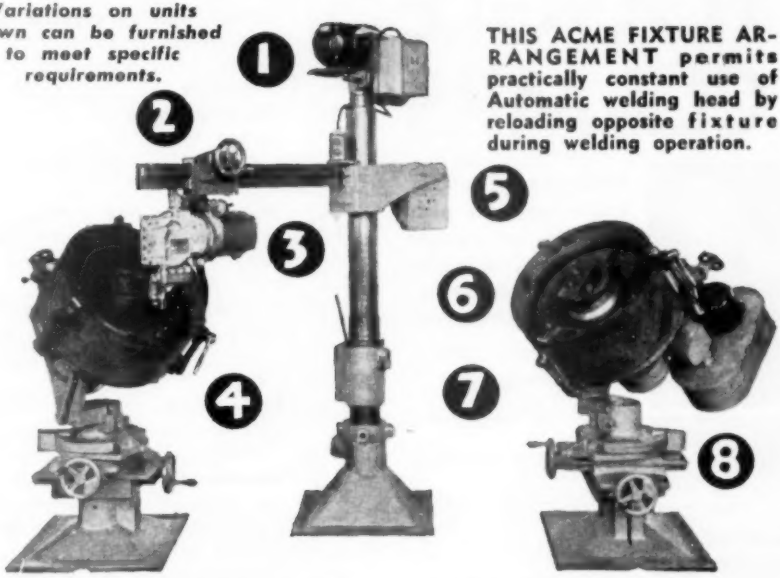
60 **Pipe notching tool** for joints to be welded or brazed are covered in bulletin. VOGEL TOOL & DIE CORP. Page 92.

64 **Three new metal cutting guides** for ease in flame cutting are covered in bulletin. NEW ERA ENGINEERING CO. Page 98.

71 **New hinged clamps** for easier clamping operations are covered in literature offered by the ADJUSTABLE CLAMP CO. Page 101.

ACME *Automatic* WELDING POSITIONER and FIXTURES

Variations on units shown can be furnished to meet specific requirements.



THIS ACME FIXTURE ARRANGEMENT permits practically constant use of Automatic welding head by reloading opposite fixture during welding operation.

1. Vertical power traverse with up and down inching button.
2. Hand wheel on carriage with locking arrangement for setting automatic welding head in proper relation to work.
3. Positioner arm swings and can be locked in proper position to either fixture.
4. 22" diameter wheel shown on fixture.
5. Fixture equipped with Reeves variable speed for proper feet per minute with reversing control. Fixture with two set speeds can also be furnished.
6. Holding machine can be set in either vertical or horizontal position. Shown in 45° angle.
7. Cross slide adjustment for fine setting so welding head on arm can be placed at either fixture without further adjustment.
8. Heavy copper brushes and holders mounted directly back of fixture for ground.

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WESPO

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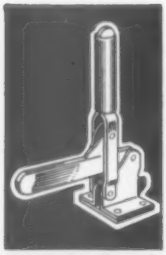
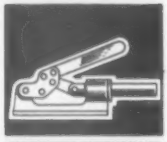


Hardened steel bushings and pins provide for longer wear—eliminate elongated holes and pin shearing.

A CLAMP FOR EVERY WORK HOLDING NEED



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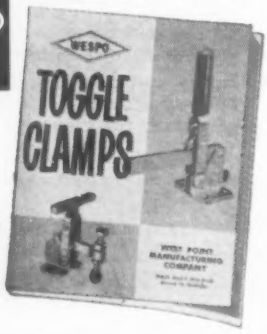

Circle No. 12 on Reader Service Card.

72 **Flux recovery units** with many new design features are covered in latest literature. INVINCIBLE VACUUM CLEANER MFG. CO. Page 103.

73 **Fifty ounce air hammers** for weld scale removal are covered in literature. SUPERIOR PNEUMATIC & MFG., INC. Page 104.

74 **Carbon welding supplies** including carbon and graphite electrodes are featured in catalog. BECKER BROS. CARBON CO. Page 104.

75 **Welding fluxes** for a wide variety of applications are covered in new folder. THE CHICAGO HARDWARE FOUNDRY CO. Page 105.

79 **New gouging and cutting** torches for heavy duty use are covered in new bulletin offered by the ARCAIR CO. Page 107.

80 **Welding and set-up platens** for easier fabrication are covered in literature. STAHL EQUIPMENT CO. Page 110.

81 **Pipe clamps** for fast, accurate pipe welding are featured in new folder. JEWEL MFG. CO. Page 110.

82 **Aluminum wire and rod** and various other electrodes and rods are covered in catalog. PACIFIC WELDING ALLOYS MFG. CO. Page 110.

87 **Bending blocks and welding platens** for welding, layout and assembly are covered. ACORN IRON AND SUPPLY CO. Page 111.

86 **Toggle clamps** for heavy duty production clamping are featured in literature. APEX WELDING & FABRICATING CORP. Page 111.

88 **Safety clothing** for long lasting protection are featured in literature. THE ALJAY MFG. CO. Page 112.

89 **Universal governors** for industrial gas engines are covered in booklet. PIERCE GOVERNOR CO. Page 112.

90 **Arc welding cable,** extra flexible, highest quality is featured in literature. STAHL EQUIPMENT CO. Page 112.

92 **Electrode holders** designed for precision arc welding are featured in literature. DURO ENGINEERING CO. Inside Back Cover.

SPEEDY is the word for SPEEDEX, the new Murex contact electrode. Iron powder in its heavy coating improves arc action and supplements the deposit from the core wire to give amazingly high deposition rates. With SPEEDEX you can increase welding output and cut deeply into time and labor costs (by far the major expense items in any welding operation).

SPEEDIER than any conventional mild steel electrode — twice as fast as an E-6012 rod — SPEEDEX provides deposition rates up to nearly 10 lbs. an hour with a 3/16" electrode, almost 15 lbs. an hour with a ¼" electrode. This means you can make single pass fillets at unheard of travel rates — 15 inches a minute or better.

SPEEDEX is an operators' rod too. They like its smooth, easy arc action — with either the drag or the open arc technique. It gives them no trouble with sidewall wash or undercutting. Its slag is almost self-removing. The finely rippled deposit has excellent surface appearance. And, under the surface, SPEEDEX welds are strong, sound and ductile — 85,000 to 90,000 psi ultimate strength with 73,000 to 78,000 yield and 15% to 25% elongation in 2 inches.

Ask to have SPEEDEX demonstrated on your production welding.

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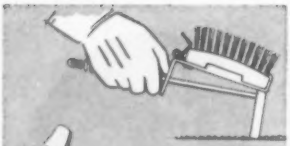
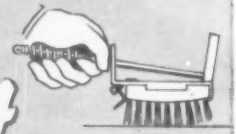
NEW DESIGN MAKES THEM BETTER 6 WAYS



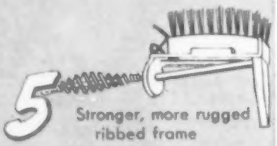
1 Chip and brush with one tool

2 Better brush angle— No bruised knuckles

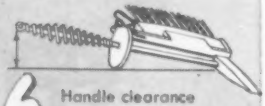
3 Easier brush removal for reversing or changing



4 Guard protects fingers



5 Stronger, more rugged ribbed frame



6 Handle clearance makes them easier to pick up.

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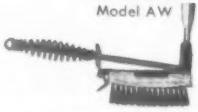

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"Re-bit" Model B-1W

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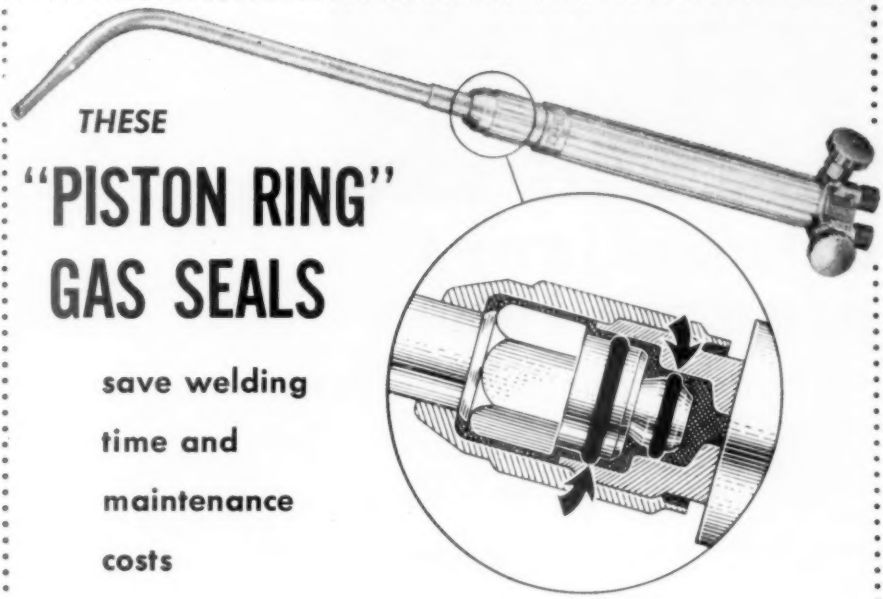

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advertisers product index

This "Equipment Index", compiled for easy reference, represents only those advertisers in this issue whose product information was available prior to our closing date. All of our advertisers, however, are prepared to supply you with full particulars regarding their equipment, services and materials necessary to most effectively carry out your welding program.

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These special Mallory electrodes provide an infinite variety of angles and nose shapes, in cast, cold forged, and cold bent construction. Many are also available with the exclusive Mallory *fluted* water hole—*increasing internal cooling area 70%* over standard round hole electrodes—and insuring longer electrode life.

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Either call your distributor or write directly to us for a copy of our newest Resistance Welding catalog. It contains complete data on Mallory electrodes, holders, rods and bars, dies, castings, forgings and accessories.

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BRAZE WELDING

CONVEYOR DRIVE SPROCKET that was repaired by braze welding with ANACONDA-997 (Low Fuming) Bronze Rods in only 7 hours. Braze welds made with these rods are clean and strong . . . require little finishing.

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SAVED: one expensive drive sprocket *plus* 53 operating days

Replacement of this fractured conveyor drive sprocket would have meant a two-month wait for delivery . . . and considerable expense to its smelting-plant owners. An inexpensive braze-weld repair had it back in operation in a matter of days. Job time was only 7 hours—4 in preparation, 3 in welding. Twenty pounds of 3/16" and 1/4" ANACONDA-997 (Low Fuming) Bronze Welding Rod were used.

Owner Walter Shanowsky, Universal Welding Co., Rochester, N. Y., reports that ANACONDA-997 (Low-Fuming) Bronze Rod gave a fast, sound weld. These rods 'tin' readily, flow freely and have good tensile strength. They melt at relatively low temperatures . . . work requires less preheating, so danger of warping or cracking is minimized.

Universal buys all its ANACONDA Welding Rods from the Welding Supply Corp. in Rochester. ANACONDA Welding Rods for almost every type of repair and production job are available from distributors throughout the United States and Canada. For latest tips on welding, write for Publication B-13 to: *The American Brass Company, Waterbury 20, Connecticut. In Canada: Anaconda American Brass Ltd., New Toronto, Ontario.* 53166

braze or weld with confidence...

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welding rods

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7,980 PHOSON BRAZED JOINTS

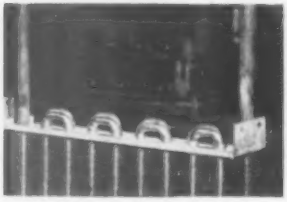
3 REJECTS

Reports **BUSH** *on Refrigeration Coil*

Bush Manufacturing Company, Hartford, Connecticut brazes 24 alloy rings on copper U bends in a continuous chain belt operation through fixed torches. The brazing process is automatic.

Testing each assembly under 300 pounds of air pressure, Bush reports only **three** rejects in 7,980 joints.

Bush also produces 8 times as many units the STRONG, LOW TEMPERATURE, PHOSON WAY, than with the old torch and rod method.



1. Refrigeration coil U bends shown with PHOSON brazing rings in position ready for production brazing.

2. View of straight line PHOSON brazing operation showing fixed torches and continuous belt action.

3. This is the finished PHOSON brazed refrigeration coil. No further machining or polishing needed . . . a clean, smooth job every time.

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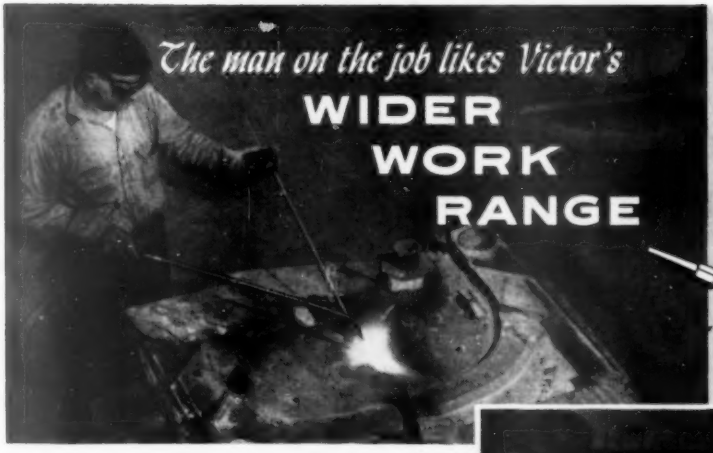

Using a VICTOR No. 310 torch butt with two S2 extensions and No. 8 type 4 tip, Joe Wyman (Shreve Welding Co., Oakland, Calif.) repairs cast iron heating boiler header with VICTOR No. 1 low fuming manganese bronze rod. Inset photo shows 5/64" build-up on undersize castings, done with same No. 310 torch but with No. 5 type 4 nozzle and VICTOR No. 6 square cast iron rod.

VICTOR'S wider work range pays off from the day you select your first VICTOR welding outfit on through a lifetime of reliable service. You buy the torch you need for your present work, add extensions, cutting attachments or special nozzles as they're needed. Result: top-quality equipment that's always perfectly matched to your needs!

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. . . ask him to show you why it costs less to own and operate VICTOR.

VICTOR for welding

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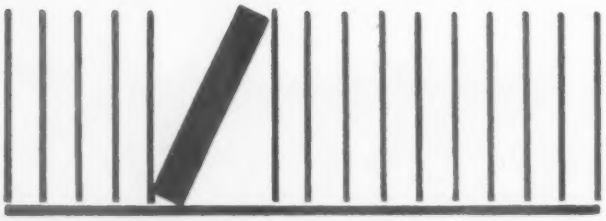


useful free literature

The publications featured on these pages were written by experts. They are FREE to our readers. To obtain these helpful reference materials use the postcard bound into this issue.

NEW HARDFACING ALLOYS CATALOG. A complete line of hardfacing and buildup rods and electrodes are fully described in a new 48-page, two-color catalog just published by the American Manganese Steel Division. Typical applications are shown in over 70 photos, and full metallurgical and physical properties are included for the four automatic and fifteen manual rods and electrodes. There's also a complete technical section with charts and photos which can help you select the correct hardfacing rod for those unusual or hard-to-solve wear problems. **Circle No. 110 on Reader Service Card.**

PIPE JOINT COMPOUND—IN STICK FORM, easily applied by stroking across the threads of male parts only is featured in a new folder offered by the Lake Chemical Co. Available in two sizes, and for use on all types of metal and plastic threads, these economical Pipetite-Stiks are said to make leak-proof seals for all types of liquids and gases even under pressures up to 2100 lbs. **Circle No. 111 on Reader Service Card.**

HERE IS A CATALOG! Thirty-five full sized, illustrated, information packed pages make up the A. O. Smith Corp's, brand-new catalog on their cast iron, mild steel, low hydrogen and high tensile low alloy electrodes. Each page is devoted to a type of electrode—that electrode's use in welding, its description, recommended amperage and voltage range—and, this is important, procedure used for welding. On pages 4 and 5 there's a complete electrode selector chart laid-out in an easily understood format. You'll find that this catalog will be an important addition to your welding "library"—and it's free! **Circle No. 112.**

THERE'S NO NEED FOR BACK-UP PLATES when you use the new Aircospot inert gas-shielded spot welding gun which is covered in detail in a new folder offered by the Air Reduction Sales Co. How this gun welds from one side only—is described with illustrations, plus physical and electrical specifications and operating data. **Circle No. 113 on Reader Service Card.**

"DESIGN OF HEAT TAP TEE CONNECTIONS IN HIGH PRESSURE PIPE LINES"—a reprint of a paper presented before the American Society of Mechanical Engineers, is now available from the Taylor Forge & Pipe Works. Bulletin 533, complete with photos and graphs deals with the problem of making branch connections to highly stressed transmission and distribution lines without the interruption of fluid flow. Analysis and solution of this problem is offered plus a suggested design approach. **Circle No. 114 on Reader Service Card.**

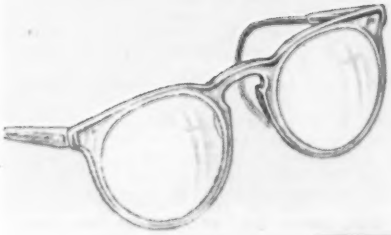
TRAINING FOR WELDING OPERATORS. A new illustrated, 24-page booklet describing the courses and organization of the Hobart Trade School is now available from the Hobart Bros. Co. Descriptions of the courses offered include arc welding, carbon arc welding, alloy steels and cast iron, inert-gas shielded arc welding, hard facing, tool welding, stud welding, submerged arc welding, oxy-acetylene welding and cutting and pipe welding. **Circle No. 115 on Reader Service Card.**

VALVES AND FITTINGS MEETING EVERY APPLICATION where gas or compressed air is used in soldering, brazing, metal melting and sand blasting are featured in a new catalog offered by the Torit Mfg. Co. Illustrated release gives pertinent information on these needle-type valves which come in sizes to fit iron pipe up to ½-in. in diameter, as well as rubber and copper tubing to ¼-in. inside diameter. **Circle No. 116 on Reader Service Card.**

PRODUCTS FOR ARC WELDING manufactured by the Tweco Products Co. are given wide coverage in a new, colorful booklet offered by the firm. Twecolog No. 9 features electrode holders, ground clamps, cable connectors and accessories. Consumer quantity prices are also included. **Circle No. 1.**

WHETHER YOU USE PLASTIC OR METAL FRAMES

Depend on **PENOPTIC** **SPECTACLE TYPE SAFETY GOGGLES**



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220 SERIES

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Model 707C — Rocker pads; cable temples.
Model 707R — Rocker pads; spatula temples.

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Circle No. 22 on Reader Service Card.

MANUAL ON CONTACT ELECTRODES giving complete data on the use of contact electrodes for a wide range of welding applications, has just been published by R. I. Mendels, Inc. Welding procedures for butt-on, vee, fillet and lap joints; making spot welds and the cutting of steels with these electrodes are covered in detail.

Circle No. 118 on Reader Service Card.

PORTABLE, ECONOMICAL ARC WELDER equipped with free-wheeling casters so that it can be easily moved, is covered in a new data sheet offered by the Borm Mfg. Co. Pertinent data covers the Model WA-150 including its 16 graduated heat tap which allows for all work in the general field of repair welding; how it's operated by switching arrangement eliminating changing of cables or plugs; electrical specifications and ordering data.

Circle No. 119 on Reader Service Card.

COMPLETE WELDING FACILITIES designed for rapid and efficient fabrication of any type of weldment are described in a new, attractive brochure offered by Gusset Boiler and Welding, Inc. Complete information from plant facilities to engineering services is included.

Circle No. 120 on Reader Service Card.

A GUIDE TO ECONOMY FOR METAL PRODUCTS pointing out that through proper maintenance and repair, prolonged life and increased quality may be obtained economically is now available from Ampco Metal, Inc. Described are the various characteristics and properties of Ampco-Trode, Grades 10, 160, 200, 250 and 300 as well as the Phos-Trode line. Electrode sizes and specifications of these grades are also included. Each grade description is followed by a list of applications recommended for that specific grade.

Circle No. 121 on Reader Service Card.

TINNING AND SOLDERING COMPOUNDS which clean, tin and solder in one operation are covered in a new brochure offered by the Pal-Weld Mfg. Co. There's a page of how-to-do-it suggestions on filling scored cylinders, babbitting bearings, repairing cracked blocks, body and fender repairs and tinning welds.

Circle No. 122 on Reader Service Card.

PROTECTIVE CLOTHING designed for the utmost in safety, comfort and durability is featured in a new brochure offered by the Aljay Mfg. Co. Illustrated folder gives pertinent information on the firm's Saf-T line of coats, sleeves, aprons, bibs, pants, etc., all made of fine, high quality chrome tanned cowhide.

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NEW REXARC MODEL TMA Automatic Welder

REXARC
AUTOMATIC WELDERS AND ACCESSORIES

Low Cost
Versatile
Light Weight
AC—DC Control
Short Set-up Time
18-90" Per Minute Travel
AC Control—High Frequency

See your Welding Supply Distributor or for complete details write or phone

THE SIGHT FEED GENERATOR COMPANY
59 EAST THIRD STREET WEST ALEXANDRIA, OHIO, U.S.A.

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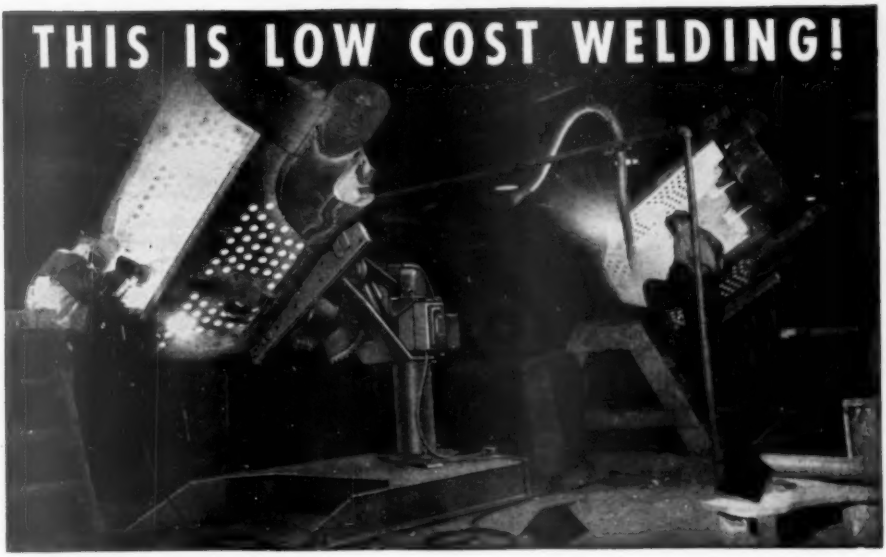
THIS IS LOW COST WELDING!



When a touch on a button moves weldments like these into the correct, most convenient position for a downhand pass, you get more arc time, more welding at lower cost. C-F power operated Positioners rotate the work in a full circle at any point in a range of 135° from the horizontal—giving welders a choice of an infinite number of downhand welding positions instantly.

Every requirement for faster, better positioned welding—constant or variable speed table rotation, full 135° tilt, self-locking gearing which holds the table in any position, oversize built-in main tilt and rotating bearings, choice of two base styles, and many other features—are built into C-F Positioners.

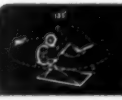
C-F Positioners are available in Hand or Power operated models, and are made in capacities up to 30,000 lbs. and larger.

Write for the new C-F Positioner Catalog

CULLEN-FRIESTEDT CO.

1315 S. Kilbourn Avenue Chicago 23, Illinois

CULLEN-FRIESTEDT CO., CHICAGO 23, ILL.



C-F positioned welds mean better, more economical welds

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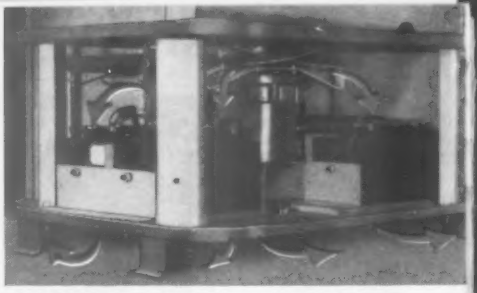
WELDING ARCS NEWS

SINGLE SCALE, DUAL RANGE make current setting easy. Welder can be supplied either for 2-phase or 3-phase power.



REVERSIBLE FAN above rectifier is used to blow dust from rectifiers and transformer to prolong rectifier life.

FULL-TIME ARC FORCE CONTROL, being switched on, minimizes stubbing and freezing-in on tough welding jobs.

Announcing — the first of a new line of powerful G-E rectifier welders

New 400-amp General Electric rectifier set includes new features for longer life and improved performance

Now, before you buy any d-c welder, be sure to try the 400-amp G-E rectifier set—first of a new line to be introduced this year. It's a full-fledged 400-amp unit, fully capable of short-time 500-amp output.

CHECK THESE USER BENEFITS

Easy Operation—instant starts, precise current-control please operators.

High Production—stable arc increases speed, quietness reduces fatigue.

Long Life—due to lack of moving parts (except fan), silicone insulation.

Low Operating Costs—because of high efficiency, low idle-time power consumption, and easy-access design.

TWO NEW MONEY-SAVING FEATURES

Reverse-draft Fan—powerful ventilating fan can be reversed to blow dirt off rectifiers and transformers. This cleaning action minimizes a major cause of rectifier failure.

Full-time Arc Force Control—optional equipment—lets you hold a short arc on those extra-tough jobs with little chance for popouts or freezing-in.

CONTACT YOUR G-E DISTRIBUTOR

For full data on this new rectifier welder, contact your G-E Welding Distributor. He's listed in the yellow pages of your phone book under "Welding Equipment—General Electric." General Electric Co., Schenectady 5, N. Y.

710-16E

Circle No. 140 on Reader Service Card.

ELECTRODES

New General Electric Strikeasy 1 electrode for fast contact welding

Actual comparison tests indicate that General Electric's new Strikeasy 1 electrode produces significantly more weld footage in a given time than high-quality E-6012 and E-6020 electrodes. This high speed can save you as much as 35% in total welding costs.

The new G-E Strikeasy 1 electrode has a rutile coating enriched with powdered iron. This iron melts to form part of the weld bead, greatly increasing the rate of metal deposit. The new electrode operates on AC or DC and is available in 1/8", 5/32", 3/16", 7/32", and 1/4" sizes.

WIDELY APPLICABLE

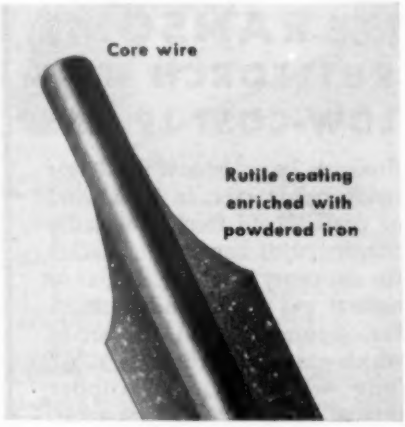
The Strikeasy 1 electrode is for certain mild-steel and low-alloy welding where you would normally consider an E-6012 or E-6020 rod. Typical uses include low-pressure storage tanks, machine bases, and light structural work.

OTHER PERFORMANCE BENEFITS

- **Less Spatter**—as much as 80% less, a real saving in material.
- **Self-cleaning**—no need to hammer and chisel to remove scale.
- **Easy-to-use** — operates smoothly, minimizes d-c arc blow, cuts fatigue.

Contact your nearby G-E Welding Distributor today for samples of the amazing new General Electric Strikeasy 1 contact electrode.

SEE THE DIFFERENCE! New G-E contact electrode produced 19" fillet in 88 sec. E-6020 rod produced 8" fillet in 75 sec. Both tests involved 3/16" rods on 1/4" mild steel using 230 amps DC.



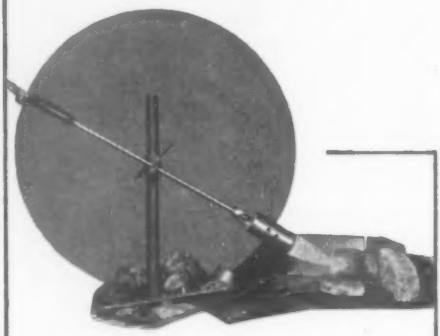
POWDERED IRON in coating of new General Electric Strikeasy 1 electrode increases rate of metal deposit.

You'll Find the Best Electrode for Your Job in the G-E Line—Most Complete in the Industry

GENERAL ELECTRIC

Circle No. 25 on Reader Service Card.

for preheating
general heating
pipe bending
straightening
lead melting



USE RANSOME
RUT TORCH AND
LOW-COST LP-GAS

Produces large, intense flame that holds steady even in high wind or draft. Hand torch, but easily adapted with homemade bracket for stationary use. Use LP-Gas or natural gas (1 lb. minimum, 5 lbs. recommended) — specify which gas when ordering. 32¾" long; weight 3¼ lbs.; copper bronze head 2-3/16" diameter. Burns 50 minutes on 1 gal. LP-Gas at 10 p.s.i., $14.50 f.o.b. factory . . . order NOW.

Dealer inquiries invited.

RANSOME COMPANY
Liquified Petroleum Gas Division
Room L-3 4030 Hollis St., Emeryville, Calif.
37

Circle No. 26 on Reader Service Card.

METAL CLEANERS FOR STAINLESS STEELS AND MONEL, which not only clean and polish but protect surfaces to normal weathering are given complete coverage in a new brochure offered by the Nu-Steel Co. Brochure offers application directions for these cleaners when used in the fabrication and maintenance of metals and metal alloys.
Circle No. 124 on Reader Service Card.

COPPER BASE ALLOYS — THE NI-VEE BRONZES are covered in a new bulletin offered by the International Nickel Co. The 12-page bulletin, with 35 tables, charts and illustrations, presents a family of low shrinkage, heat treatable bronzes for machine component pressure and bearing castings, that develop mechanical properties in the "as-cast" condition. Typical composition and applications are given.
Circle No. 125 on Reader Service Card.

QUICK REFERENCE CATALOG ON PIPE TOOLS all designed for more efficient pipe preparation and installation is now available from Beaver Pipe Tools, Inc. Descriptions, photos and ordering data for the firm's complete line of pipe tools are given.
Circle No. 126 on Reader Service Card.

CIRCLE NUMBERS ON THE CARD AND MAIL!

WHAT'S THE COST OF TRAINING APPRENTICES? A 24-page pamphlet entitled "Evaluating Apprentices" has just been issued by the Bureau of Apprentices, U.S. Department of Labor, which includes an accounting system itemizing more than 50 cost and profit items involved in apprentice training; a series of forms for recording hours and grade ratings of apprentices as they progress during their training, and summary forms for annual and final records.
Circle No. 127 on Reader Service Card.

AUTOMATIC TAKE-UP REELS for hose, cable, wire and portable tools are given complete coverage in a new, illustrated brochure offered by the Appleton Electric Co. Reels are available in various sizes and styles, all designed for trouble-free and easy use. The usual, but helpful, catalog data is included.
Circle No. 128 on Reader Service Card.

SMALL, LIGHTWEIGHT FLEXIBLE SHAFT MACHINES are headlined in the new Bulletin 536 offered by the Stow Mfg. Co. Illustrated release shows how finishing operations can be done efficiently without operator fatigue, plus a new type of anglehead which consists of a flexible shaft inside of a solid tube with adjustable handle.
Circle No. 129 on Reader Service Card.

CESCO RIGHT... before your Eyes!

WHERE TO BUY IT

ATLANTA, GA.
Guardian Safety Equipment Co.
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BIRMINGHAM, ALA.
Guardian Safety Equipment Co.
4215 1st Ave. No.

BOSTON, MASS.
General Equipment Corporation
261 Franklin Street

BUFFALO, N. Y.
The Watson Company
1443 Main Street

CHICAGO, ILL.
Universal Safety Equipment Co.
5115 Diversey

CINCINNATI, OHIO
Williams & Co., Inc.
3231 Freeborn Avenue

CLEVELAND, OHIO
Williams & Co., Inc.
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COLUMBUS, OHIO
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DALLAS, TEXAS
Guardian Safety Equipment Co.
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ST. PAUL, MINN.
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SALT LAKE CITY, UTAH
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CESCO FOR SAFETY

Circle No. 27 on Reader Service Card.

Manhattan Moldisc—More use per dollar

A FRESH CUTTING FACE . . . throughout the life of the wheel means that Manhattan Moldiscs last longer . . . retain full metal removal efficiency right down to the last usable part of the wheel. The secret — Manhattan's special molded, resinoid bonded abrasive which presents a fresh cutting surface throughout the wheel thickness, and which does not load or glaze. Actual plant tests show that Moldiscs effect important savings in faster grinding time and fewer time-outs for disc changes. For MORE USE PER DOLLAR and better quality work specify Manhattan Moldiscs. Bonded in various resiliencies from fast roughing to fine finishing. Standard size 7″ x ¼″ x ⅞″. For speeds to 6,000 RPM. Mounting flange and nut furnished on request.

GRINDING WHEEL INSTITUTE MEMBER

WRITE TO ABRASIVE WHEEL DEPARTMENT

RM

MANHATTAN RUBBER DIVISION—PASSAIC, NEW JERSEY

RAYBESTOS-MANHATTAN, INC.

Manufacturers of Mechanical Rubber Products • Rubber Covered Equipment • Radiator Hose
Fan Belts • Brake Linings & Blocks • Clutch Facings • Packings • Asbestos Textiles • Teflon
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MR 943-R

Circle No. 28 on Reader Service Card.

How Ni-Rod "55" saved $1,200 ...and prevented a loss of $70,000

Successful welding of water jacket casing with Ni-Rod "55". The casting is wrapped in an asbestos blanket to retain heat.

Close-up of crack in water jacket casing chipped and ready for welding.

During one long spell of zero weather in Canada last year, it got cold enough to crack the water jacket castings on a butane reciprocating pump at a large oil refinery and stop production.

New castings would take 17 weeks for delivery—a loss in production of nearly $70,000. In addition, they would cost $1,200.

The only alternative was to try welding.

First the welders drilled the ends of the cracks to prevent them from propagating.

Then the castings — gray cast iron — were slowly preheated for an hour and a half to 500° F. with an oxy-acetylene torch and wrapped in asbestos blankets.

One-eighth diameter Ni-Rod"55"® was used and each bead was well peened.

No post heat was required and the castings were cooled slowly in powdered lime. Four days later the pump was back in service!

Success stories like this are a common thing when Ni-Rod "55" is used. Ni-Rod "55" gives you sound, machinable welds in heavy cast iron sections, high phosphorous irons, Ductile Iron, Ni-Resist®, special alloy irons, high-strength cast irons, and when welding these irons to steel. Usually Ni-Rod "55" can be used without preheating or post heating. And it provides a stable arc with a minimum of spatter to give a smooth bead contour.

Your distributor of Ni-Rod "55" will be glad to help you with special welding problems.

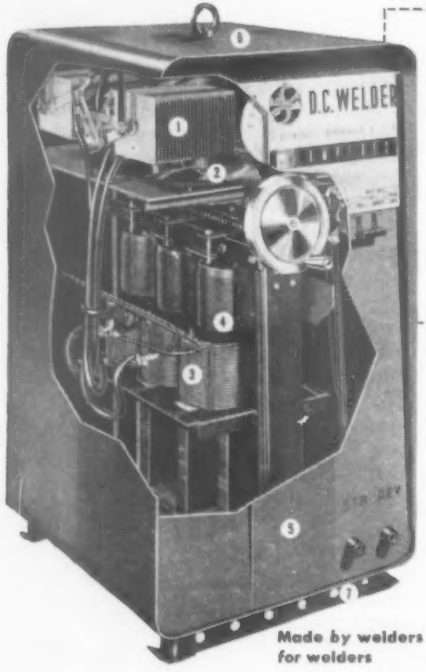
Discuss your welding problems with Inco's welding engineers at the 2nd National Welding Show, May 5-7. (Booths 158-161, Memorial Auditorium, Buffalo, New York)

INCO NI-ROD TRADE MARK

THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall Street New York 5, N. Y.

Circle No. 29 on Reader Service Card.

First year's savings can repay your investment in A. O. Smith D.C. Rectifier welders that replace motor-generator sets. **44% more efficient** in operation than heavy rotary equipment! **End costly maintenance** . . . add the benefits of better, smoother, faster welding at much less cost.



Made by welders . . . for welders

A.O.Smith

D. C. RECTIFIER WELDER

1. Rectifier stacks are cooled by fresh air drawn in at the top by **2.** Life-time industrial fan, which then blasts air down over **3.** Heavy copper, fibrous glass-insulated transformer coils. **4.** Primary coils move up or down for current setting on ball-bearing jacks under stepless, non-creep current control. An illuminated scale is easy to read. All parts are easily accessible for maintenance by removing a few screws and a panel of the **5.** Attractive, restful-green, baked-on enameled steel case. **6.** Eye-bolt for hoist and **7.** Floor clearance for handling with fork-truck makes the A. O. Smith Rectifier portable.

Write Dept. IW-354 for complete details

A.O.Smith CORPORATION

Welding Products Division, Milwaukee 1, Wisconsin
International Division: Milwaukee 1, Wisconsin

Circle No. 30 on Reader Service Card.

Worn earth moving parts can be rebuilt for 40 percent of the cost of replacement parts and will give increased service life. Here's how . . .

Automatic Submerged Arc Saves 60% When Rebuilding Worn Equipment

by IVAN R. BARTTER, G.M.
Automatic Welding Co.
Elm Grove, Wisconsin

WITHOUT arc welding for equipment maintenance, contractors who use earth moving machines, quarry operators, mining companies and many industrial establishments would find it difficult to operate. Until recently, however, most such arc welding has been done by hand. Although this welding has been a life saver in many cases and will continue to be, it is far slower, less satisfactory and more costly than automatic hidden (submerged) arc welding done with modern equipment and properly designed fixtures.

With proper set-ups, such as have been devised and extensively used by Automatic Welding Company, Elm Grove, Wisconsin, welding is done from two to eight times as fast as hand arc welding, and the quality of welds produced is notably superior to hand welds.

Figure 1—Automatic welder equipped with automatic welding head and a positioner having an indexing plate that carries four gear driven spindles, each of which supports a crawler tractor track roller whose surface is to be built up.

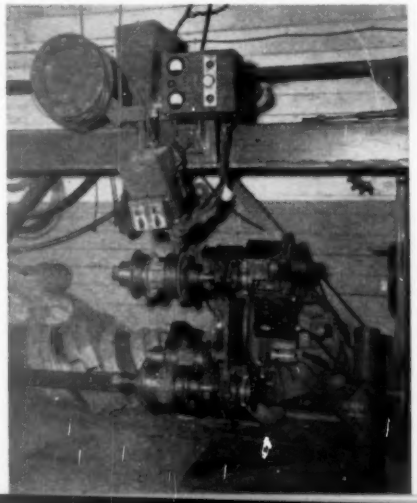
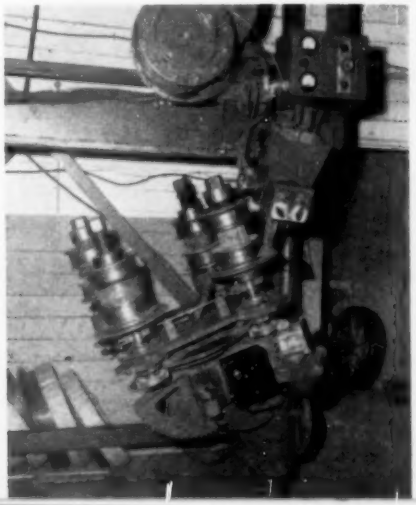


Figure 2—Same machine is shown here with the plate supporting four track rollers rocked into position for automatic build-up of flange faces. Each spindle rotates as the carriage feeds the head horizontally while the beads are laid down.



In an average case, the welded component, which usually involves hardsurfacing that is highly resistant to wear, costs about 40 percent of the replacement parts otherwise required. Moreover, the rebuilt part generally has a longer service life than a new unit because of superior resistance to wear.

Among its most important types of work undertaken to date are those required to rebuild the exposed and rapidly wearing parts of crawler tractors of many makes, notably track rollers, idlers, the linked track rail itself, grippers, sprockets and related parts.

Design Of Fixtures

In designing its own "fixtures", most of which are more properly referred to as welding machines, standard components were used where they met requirements. These were supplemented, however, by such specially built components as best adapt the particular machine to the jobs it must do.

Lincolnweld automatic heads and Lincoln generators with supplementary control equipment of the same make are used and Lincoln welding wire and flux are employed extensively, but some other makes are applied for special purposes. One semi-automatic "squirt" welder is used for some work not adaptable to fully automatic procedures and some hand welding machines are applied, although the proportion of hand welding is small. Oxyacetylene flame cutting is done where needed.

Crawler tractor rollers of which there are ten to twelve per tractor, are among the parts resurfaced in largest volume. For this work, the machine shown in Figures 1 and 2 is applied. Its automatic head is mounted on an elevated horizontal track along which the head is traversed longitudinally. To handle

Figure 3—Worn track idlers for crawler tractors and similar parts are rebuilt by laying down weld beads on worn surfaces in this machine. Flux feed keeps the arc submerged and fast as well as precise welding is done.

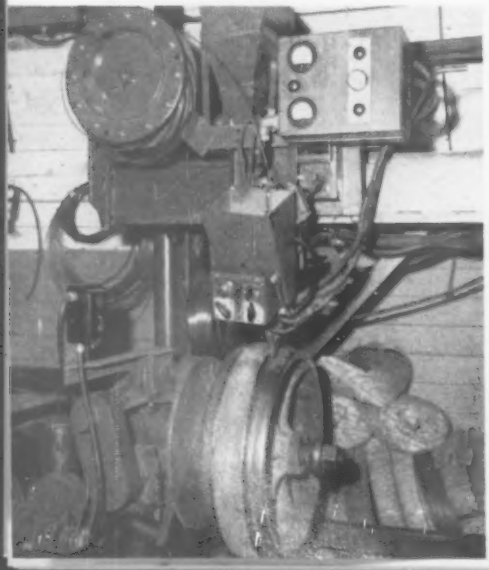


Figure 4—Close-up of the carriage and the automatic head it supports making a continuous weld to build up a track rail that is supported and covered with flux on the steel bed in front of the operator.

rolls of different diameters, the head proper can be raised and lowered, but once set, usually need not be moved vertically in rebuilding the cylindrical surfaces of a set of four rolls.

To support and rotate the rollers processed in this machine, a standard positioner had been altered to include four spindles supported on a plate that can be indexed 90° for welds on successive rollers, only one of which is held in welding position at a time (Figure 1). After cylindrical surfaces of the rollers are built up, the positioner is rocked to bring roller axes to an inclined position (as in Figure 2) so that flanges can be built up at the specified angle. For this work, the carriage of the machine is moved to the right and is traversed radially as the flange bead is laid down.

Rebuilding Procedures

Procedure in rebuilding rollers is as follows: Bearings, bushings and shafts are removed and each roller is then washed thoroughly or is steam cleaned to remove all oil, grease and dirt. One roller is then mounted on each of the four supporting spindles. Then one layer of weld metal is applied to cylindrical surfaces of the roller directly below the head. This is done, of course, with the roller rotating (at a surface speed of about 25 inches a minute) and with the head traversed horizontally very slowly so that a continuous bead that fuses with the adjacent bead is laid down.

When the head has applied one layer across one cylindrical surface, the head is raised and traversed to do the corresponding surface at the opposite side of the roller. Then the head is raised and the plate is indexed 90° to bring the No. 2 spindle into position, after which the operation is repeated on the second roller. Subsequently, the same processing is repeated on the third and fourth rollers. Flux adhering to welds is chipped off by the operator if it does not drop off during cooling.

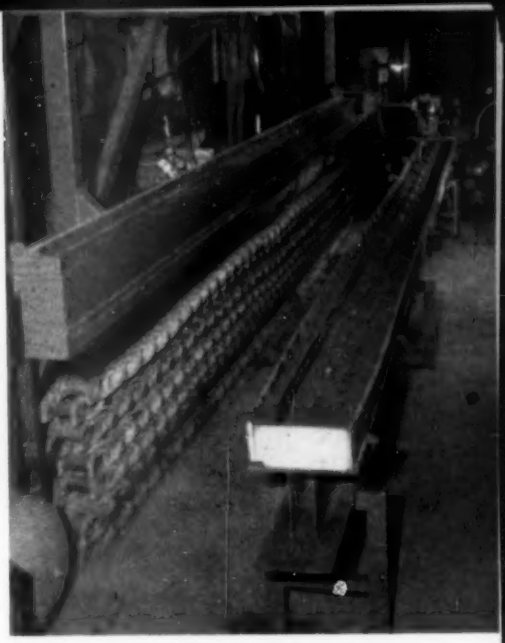


Figure 5—Rebuilding surface of worn track rail. Worn surface is supported in 34-foot trough-like bed and covered with flux to submerge the arc as the carriage advances the welding head.

Cooling Reduces Shrinkage

During a complete cycle, the rollers cool after one layer of build-up is applied and the roller is indexed out of welding position. This cooling not only reduces bore shrinkage that would be excessive if the entire multi-layer build-up was applied in one continuous set of passes, but yields smoother welds. It also makes the removal of adhering flux less difficult. Second, third and subsequent passes needed to build rolls up to original

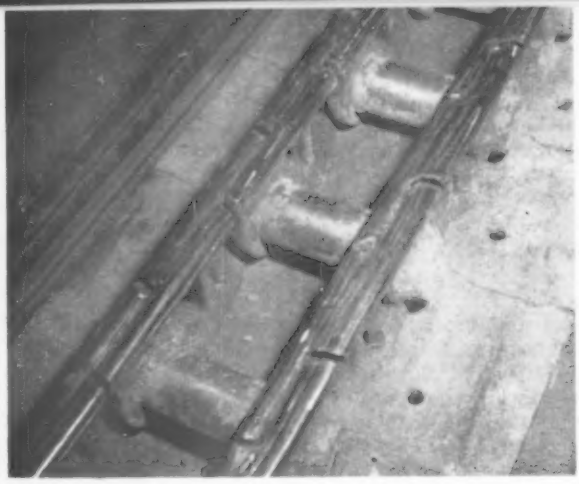


Figure 6—Close-up of a portion of a rebuilt track rail as it appears after the joints, where valleys were filled in temporarily, have been flame cut to separate the respective links. Prior to the cuts, the welds were continuous.

diameter are made in the same way, cooling being done after each successive layer is completed.

After cylindrical surfaces of rollers are built up, the positioner is tilted to the position shown in Figure 2 and flange build-up is done at successive spindle positions. When flanges at one side are built up, the rollers are shifted end for end on the spindles to build up the flanges at the opposite sides.

Minimize Eccentricity

With this set-up, it is not only possible to effect the build-up rapidly but to keep the cylindrical surfaces produced so true that eccentricity does not exceed $\frac{1}{32}$-inch without any grinding or other machining of the built up surfaces, thereby saving the cost of such extra machine work.

When all surfaces are up to specified size, the rollers are permitted to cool to room temperature. Each roller is then centered from its caps in a boring mill and the bore (which has contracted as above noted) is finished to the specified size.

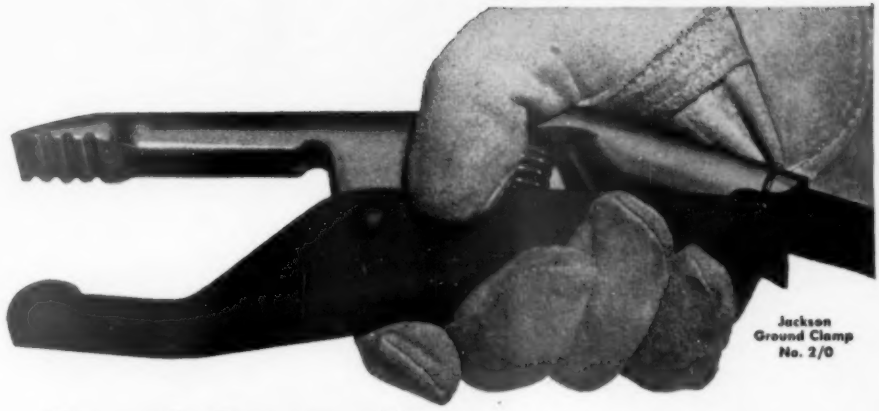
Increased Wear-Resistance

Reboring completes the reworking of the roller and makes it ready for bearings, shaft and seals to be reassembled. Welding build-up and refinishing of the bore plus dismantling, cleaning and reassembly cost the user an average of only 40 percent as much as new rollers, yet provide rollers that will outlast new ones by 50 percent or more.

Rollers usually are forged from steel having 0.035 to 0.050 carbon content. In such cases, the build-up is commonly started with high carbon wire and successive layers are produced with alloy wire. Practice usually is such as to yield about 42 Rc hardness. Greater hardness can be obtained, but is likely to result in checking or in spalling in service and so is less satisfactory.

In an average case, about three layers, each of which increases diameter by about ¼-inch, restore the original diameter but either more or less metal can be applied. In resurfacing, $\frac{5}{32}$-inch wire and a welding current of about 400 amps are used. High chrome-molybdenum-vanadium hardsurfacing deposits are obtained either by using alloy filler wire and a standard flux or mild steel electrode wire and a hard surfacing flux that supplies the alloying ingredients.

(Turn to Page 68)



Jackson
Ground Clamp
No. 2/0

Good Grounds
for Welding Profits

Now a convenient *hand tool* as well as a superior *electrical fitting*, the improved Jackson Ground Clamp, more than ever, goes easy *on* . . . easy *off*.

With the upper tong fitting the palm, and the lower tong fitting the fingers, the clamp opens easier and wider to grip the work. Also, the current carrying *upper* tong naturally will be placed *up*, where it is easier to make sure of firm and clean metal-to-metal contact.

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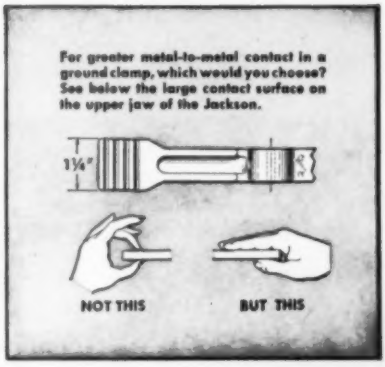
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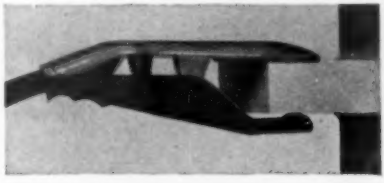

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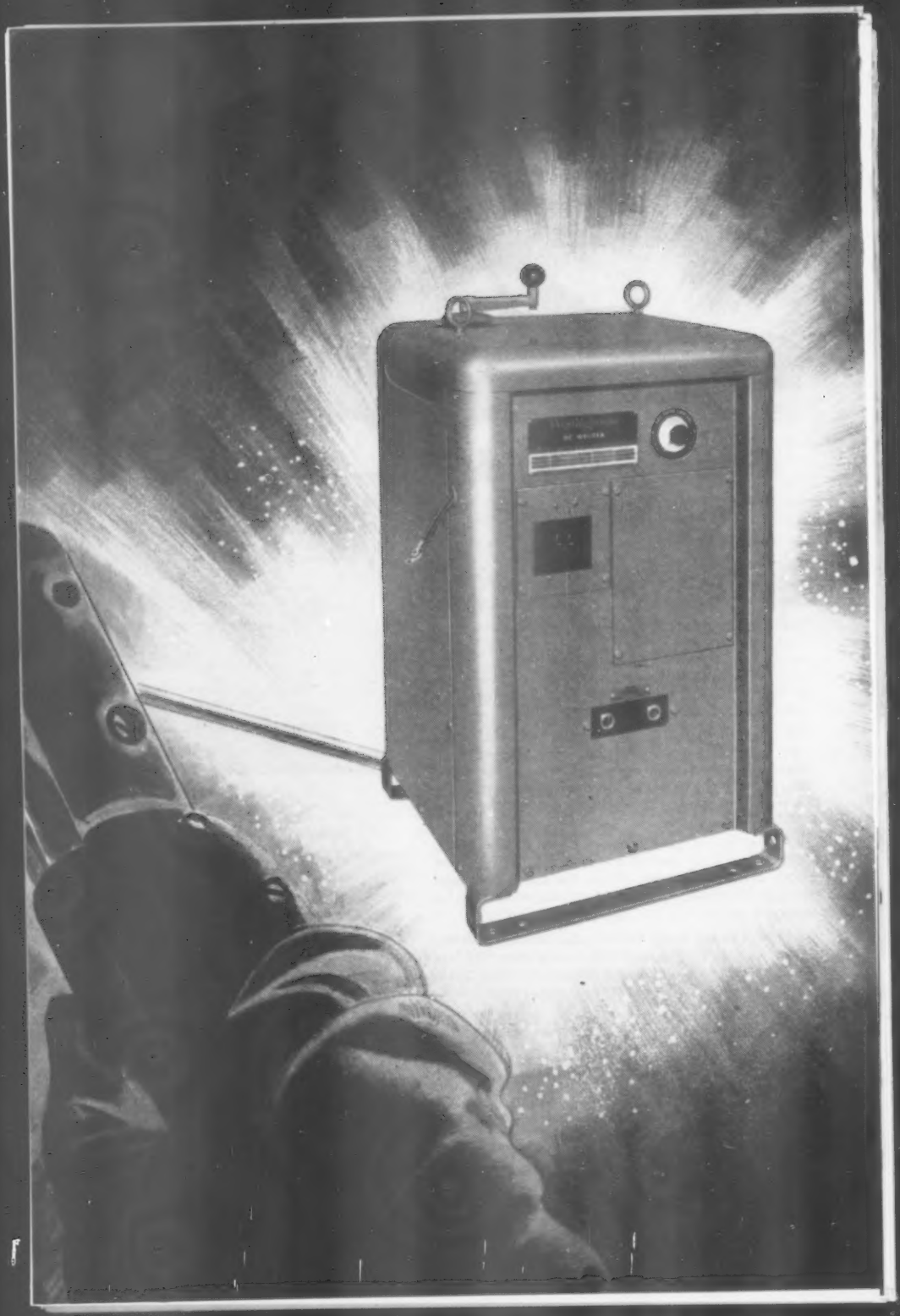

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When spot welding aluminum with conventional single-phase alternating-current type welders . . .

"Slope Control" Lengthens Tip Life and Improves Weld Quality

by CHAS. BRUNO
Chief Welding Engineer
Reynolds Metals Company

WHEN spot welding ferrous materials, deformation of the tip surface is the factor determining tip life. When welding aluminum, however, it is not tip deformation, but tip *pickup* that determines tip life.

Tip pickup, in turn, is a function of tip temperature. So one of the ways that helps to lengthen tip life is to refrigerate the tips and thus hold down their temperature during welding.

Another method that has proved highly satisfactory is to control the application of welding current in such a manner that it is allowed to build up gradually, instead of applying full current immediately. This is easy to do with stored-energy welders but until recently, it was not practical to control the welding current in this manner with conventional single-phase alternating-current tube welders.

Now electronic devices have been developed to provide this control when spot welding with conventional 60-cycle A-C machines. With these units, any A-C welder can be made to produce good, high quality welds in aluminum. These so-called "slope controls" restrict the current flow during the first few cycles, allowing it to gradually build up to maximum welding current. Lengthening by a few cycles the time the welding current flows, compensates for the reduced current at the start of the weld, thereby giving the same total heat input to the weld as without slope control.

TABLE I—ELECTRODE LIFE

Material Thickness Inch	Number of Spots Before Sticking	
	Without "Slope Control"	With "Slope Control"
On Alclad 24S-T Aluminum		
.025	15	330
.040	25	825
.064	41	1125
.081	85	1700*
On 52S Aluminum		
.062	60	450

* *Tests were discontinued before sticking occurred.*

Increase Tip Life

Table I reveals the amazing effectiveness of slope control in extending electrode life. Note that the number of welds made before sticking occurs is increased 20 to 30 times with slope control.

The factors that extend electrode life can be pointed out by referring to Figures 1 and 2. These are diagrams produced from actual oscillograph records of spot welds made with and without slope control. Analyzing these will explain how sticking is controlled.

In Figure 1, without slope control, note that the first and each succeeding half cycle of current goes to the same peak as maximum welding current before reversing to complete the cycle. Note that this first high current pulse softens the metal considerably, reducing the electrode pressure at the electrode-work interface as is shown by the comparatively large drop in the pressure curve at the very first application of current.

In Figure 2, with slope control, note that the current gradually increases during the first 4-6 cycles, producing a *gradual* softening of the metal.

Now let's refer to Table II which shows current densities and unit force at the tip. These values were calculated from the calibrated oscillograph charts from which Figures 1 and 2 were made. It will be seen that the initial current densities with slope control are *less than one-third* of those without slope control.

Reduce Tip Temperature

It is well understood that higher current densities are always accompanied by more heat and higher temperatures. In fact, the amount of heat developed is directly proportional to the current density. Thus a reduction in current density means a direct reduction in tip temperature. In this instance, the less than one-third current density with the slope control accounts for producing *less than one-third* the heat that was developed without slope control.

There is also another significant factor . . . the higher unit pressures. This is important because the heat developed at the point of contact between the electrode tip and the work surface varies in-

Oscillograph records of spot welds made with and without slope control are shown here. Analysis of these diagrams explains how slope control prevents tips from sticking and picking up aluminum when making welds.

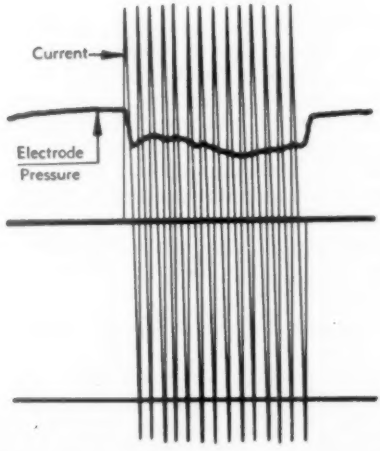


FIG. 1. Trace without "slope control".

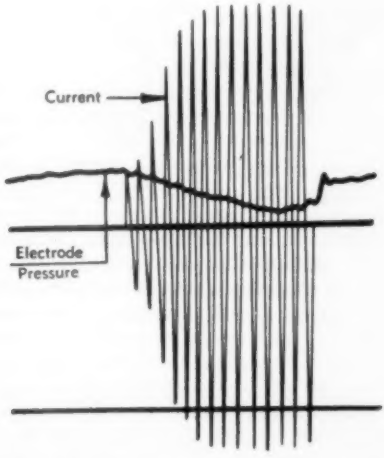


FIG. 2. Trace with "slope control".

TABLE II—DENSITY-FORCE DATA*

Time in Cycles	Without Slope Control			With Slope Control		
	Dia. of Imprint Inch	Current Density Amps./ Sq. In.	Unit Force psi	Dia. of Imprint Inch	Current Density Amps./ Sq. In.	Unit Force psi
1	.19	770,000	12,500	.14	285,000	26,000
2	.19	770,000	13,100	.15	250,000	22,000
3	.20	700,000	11,800	.18	695,000	15,500
4	.20	700,000	11,200	.20	700,000	14,000
5	.20	700,000	11,200	.20	700,000	12,500
6	.20	700,000	11,200	.20	700,000	11,200

** Current densities and unit forces were calculated from actual oscillograph traces and from surface imprint measurements caused by electrodes on 0.032-inch 52S aluminum. Figures 1 and 2 are diagrams of these same traces. Charts, data supplied by General Electric Co.*

TABLE III—RECOMMENDED SETTINGS WITH SLOPE CONTROLS*

Mat'l Alloy Temper	Thickness Inch	Weld Time Cycles	Electrode Force Lbs.	Starting Current Amps.	Welding Current Amps.	Weld Strength Lbs.	Cycles to Reach Final Current
24S-T	.025	10	700	6000	25,000	350	4
24S-T	.040	10	900	6000	28,000	550	4
24S-T	.064	10	1100	6000	31,000	1000	4
24S-T	.081	15	2500	8000	40,000	1400	5
52S	.062	10	1000	9000	31,000	900	4

** These procedures will produce welds whose strength is equal to or greater than that required by Air Force-Navy Aeronautical Specification AN-W-30.*

versely with the pressure . . . more than twice the pressure producing less than half the heat, in this instance.

Reduce Contact Temperature

Combining these two factors, it is evident that the slope control in this instance cuts the total amount of heat produced to something *less than one-sixth* (one-half of one-third). Obviously this accounts for an important reduction in temperatures at the contact surface between electrode tip and work. This in turn means that sticking and deposition of aluminum on the electrode tips are greatly reduced, because the deposition of aluminum is directly proportional to the temperature at point of contact.

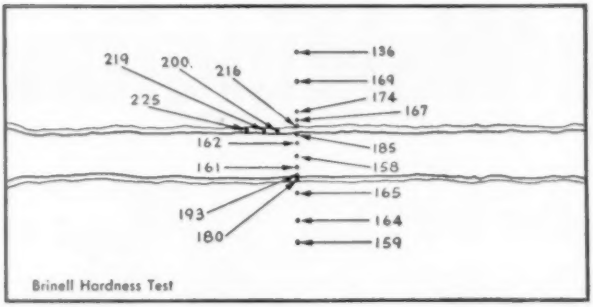
This rather technical explanation can also be interpreted in another way which may be easier to understand. *Without* slope control, the electrode tip must carry the full welding current before it gets a chance to sink into the softening metal and seat itself.

With slope control, the aluminum softens at the tip-work interface and allows the tip to sink into the work slightly *before* the full welding current is applied. Thus when maximum welding current is reached, there is a considerable portion of the tip surface contacting the work and the current is distributed over this entire area so that excessively high current densities do not occur. This, in turn, prevents sticking.

Multiply Tip Life 20-30 Times

That this theory is true becomes evident when it is noted that slope control multiplies tip life 20-30 times. This is of sufficient fundamental importance to show the way

(Continued on Page 67)



Brinell Hardness Test

This drawing shows an actual test made on a machined casting welded with Nickel-Arc. Notice that the fusion zone of the weld is less disturbed or affected by the heat of welding and remains well within the machinable range. Notice also that the weld metal has a hardness that matches that of the base metal.

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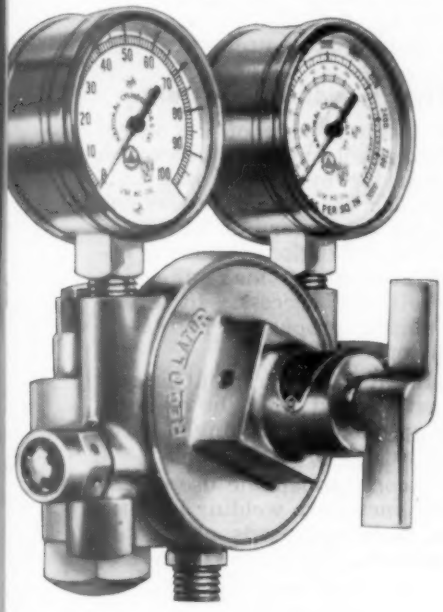

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Copper alloys and steel are often welded together to secure economy, structural strength and corrosion-resistance. Here's . . .

How To Weld Aluminum-Bronze to Steel

by LOWELL H. HAWTHORNE

THE MODERN designer, faced with problems of economy, structural strength and corrosion resistance, may wish to combine steel with one of the copper alloys in such a manner that a welded joint between the two materials becomes necessary.

Many of these joints, in non-code fabrication, only require leak tightness. Others, in stressed sections, must have adequate strength and ductility and conform to some sort of code requirement. The best of today's fabricators may, on occasion, run into serious difficulty in making satisfactory joints of this type.

To the Rescue

The Welding Section of Revere Copper and Brass Incorporated, Research Department, recently had the opportunity of collaborating with and assisting a customer to qualify a welding procedure for a joint of this kind. The joint in question involved welding 1½" aluminum bronze tube sheet (7% Al, 2% Fe, Bal. Cu) into a steel bolt ring for a large pressure vessel.

Qualify Procedures, Operators

The ultimate user of the vessel required qualification of procedure and operator by means of tensile and guided side bend tests. The fabricator asked for our assistance and recommendations following repeated attempts to make the side bend without success. In every case tensile properties had been satisfactory.

Qualification requirements specified that the test welds be made in 1½-in. plate using a single bevel groove as shown in Figure 1.

We recommended the use of gas shielded metal arc welding because of the welding speeds obtainable and because it provides complete

ABOUT THE AUTHOR

L. H. Hawthorne is a member of the Welding Section of the Research Department, Revere Copper and Brass Incorporated, located at Rome, New York.

He is a member of the American Welding Society and has served on several AWS and AWS-ASTM committees.

Mr. Hawthorne is a member of the Board of Directors of the Syracuse Section of the American Welding Society, and a member of the 1953-54 National Nominating Committee.

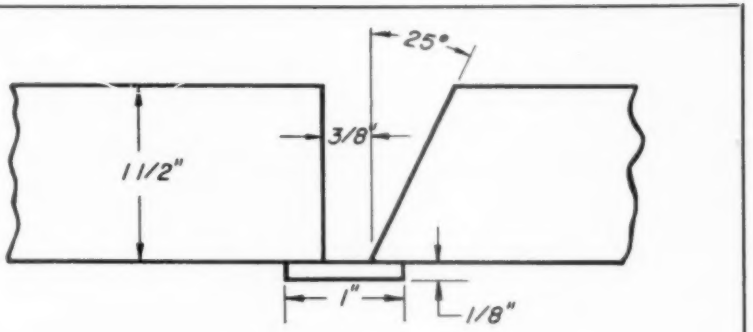

Figure 1. Qualification requirements for welding aluminum bronze tube sheet into steel bolt ring for a large pressure vessel originally specified that test welds be made in 1 ½-inch plate using single bevel groove. Change to 60° Vee-joint gave increased penetration and satisfactory tensile strength and ductility.

control of aluminum oxides which may be formed.

In all, five test plates were made in three days to develop procedures which would produce satisfactory results. These welds were made in the fabricator's shop in close cooperation with one of their welding operators.

All of these welds were made with automatic inert-arc equipment, using coiled consumable electrodes, and the following procedure details:

Filler metal—10% Al Bronze
Wire diameter—$\frac{1}{16}$-in.
Welding current—275 - 300
Arc voltage—See text
Shielding gas—Argon
Rate of flow—25 CFH
Interpass temperature—less than 212° F.

All welding was done forehand with the gun held 15° from vertical, and the only changes made during completion of experimental welds were those of technique.

Careful Wire Brushing

Each weld was carefully wire brushed prior to deposition of subsequent beads or layers. The first weld was made in a normal manner applying layers of approximately ⅛-in. thickness during each pass. *Bend specimens made from this were wholly unsatisfactory* with failure occurring at the interface between the steel and the weld.

Penetration Improves Ductility

Careful examination of the failed specimens showed that this side of the joint was essentially a braze weld which, although it had satisfactory tensile strength, lacked the necessary ductility. A few small areas which showed actual penetration into the steel gave evidence of elongation prior to complete failure of the specimens.

On the basis of this evidence, an attempt was made to get better penetration of the steel by employing a stringer bead technique with high rates of progression. This did not produce satisfactory results however, as such penetration was inconsistent.

It was clearly apparent that where penetration had been obtained, ductility of the joint was greatly improved.

In the execution of these welds the automatic wire feed had been adjusted to maintain a quiet, smooth arc. To make the third weld, wire feed speed was increased to a point where the arc was noisy but did not spatter.

A modified layer welding technique was employed in making the third test weld. First, a light, fast bead was applied to the steel side of the joint with the gun held at an angle so that the arc was directed to the steel in order to obtain as deep penetration as possible. The layer was then completed by welding this overlay to the aluminum bronze in a normal manner.

Physical Restrictions of Joint

During execution of this weld it was quite apparent that physical restrictions of the joint made it impossible to get good penetration into the steel in the root passes.

This observation was borne out in testing. Root of the joint failed immediately on bending, but it was found that if ½-in. was cut off the bottom of the coupon the upper two-thirds could be bent without failure.

In discussing the difficulties with inspectors covering this job it was pointed out that the actual weld

(Turn to Page 54)

Figure 2. Cross section of weld with fine grained structure on steel side (left) indicating amount and distribution of iron. This provided a fusion zone with sufficient ductility to successfully meet side bend requirements.

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would be made with a 60° Vee. Permission to use a similar joint in the test plate was granted.

Subsequently, two test plates were made, one by the operator and one by the writer, using the techniques employed on the previous plate. The 60° vee joint made it easy to direct the arc at the steel side of the joint to get penetration required in the overlay beads. Average rate of progression for these overlay beads was approximately 24-in./min. while rate of progression for the other beads or layers was about 8-in./min.

Make 33 Passes

Each of these welds required 33 passes to complete. Side bend and tensile coupons from both these plates were entirely satisfactory.

Figure 2 is a cross sectional photomacrograph of a weld made in the laboratory using similar procedures.

Despite the fact that side bends were made from this joint we believe that the existing standard bend tests on dissimilar metal joints do not reflect their true quality.

Failure Occurs In Overstressed Zone

When two or more materials or alloys having widely different tensile, yield and work hardening characteristics are involved in a joint such as this, the tendency to angular or short radius bending is such that failure may occur in an overstressed zone. In this instance it was absolutely impossible to make this bend in a standard guided bend jig without manipulating the specimen. Otherwise the specimen moved in the jig during bending so that the bend was almost entirely in the lower strength steel. It was necessary to locate the specimen with the juncture of the weld metal and the aluminum bronze base metal under the male portion of the jig and start bending at this point, and later relocate the specimen to keep the weld centered in relation to the bend.

For this reason we favor longitudinal face and root bends for dissimilar metal joints so that force is applied evenly to the various materials involved.

At the conclusion of our work, the inspectors, who had been extremely interested throughout, made the statement that prior to this time considerable difficulty had been encountered in qualifying this weld and that the side bend requirement had been waived.

This combination of materials, aluminum bronze and steel, may prove extremely useful in many instances, but is only one of such combinations of materials which can be utilized to combine corrosion resistance with economy and/or strength as required.

The satisfactory conclusion of this experimental work, which can be duplicated by any fabricator following procedures outlined, is an excellent example of how problems of this type can be solved by close cooperation between supplier and fabricator.

Sciaky Opens New Ohio Office

Sciaky Bros., Inc. recently announced the opening of a new branch office located at 426 Transportation Bldg., Cincinnati 2, Ohio. James King, formerly welding engineer at Surface Combustion Corp., has been named manager.

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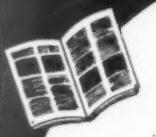

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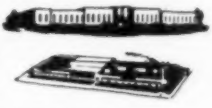

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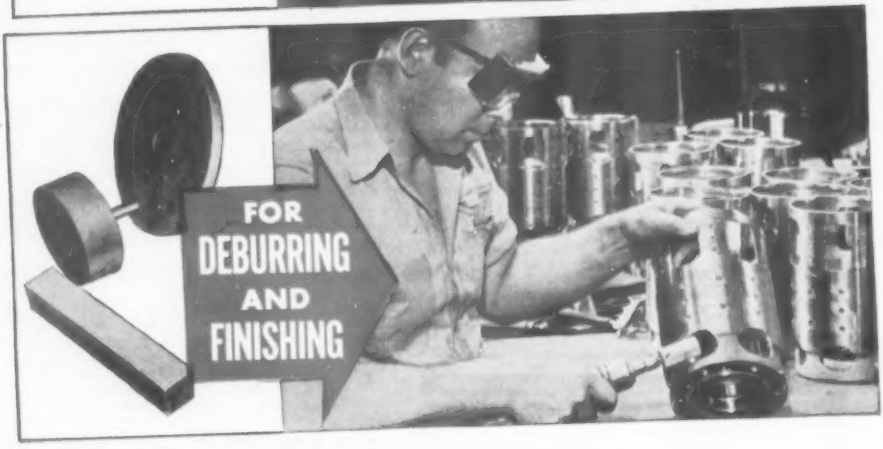

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To interpret weld radiographs you need to know:

1. The principles underlying radiographic techniques.
2. The characteristic radiographic appearances of defects, and of the modification of these appearances by various factors.
3. Details of welding processes and procedures.
4. Characteristic defects associated with a particular welding process.

How To Interpret WELD RADIOGRAPHS

● New applications of welding bring about new problems in radiographic inspection. Here is a brief account of some of the factors which have to be considered in interpreting radiographs of welds made by the various electric arc processes in steels up to one-inch in thickness.

THE procedure in examining a weld radiograph is as follows:

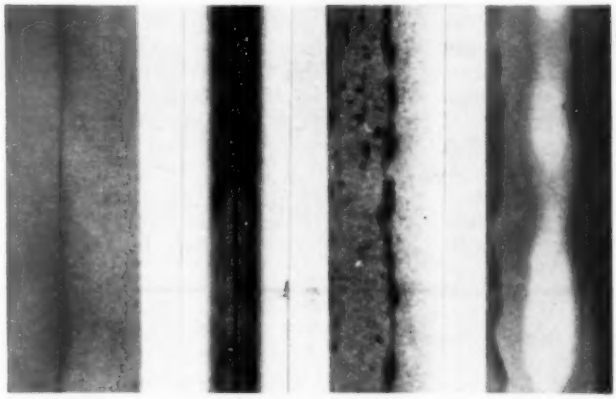
First of all the serial number, if any, is checked and then the radiograph is examined to see if it is free from spurious markings which could interfere with interpretation. The next step is to look for the recording of specified penetrameter details. The radiograph should then be examined for the presence of any blurred patches that could be caused by lack of contact between film and intensifying screens. Next, the density of the radiograph in the region of the weld image should be checked. The radiograph should be free from variations of density due to uneven development, and there should be no streaks, stains or fog patches, nor should graininess be abnormally high due to the use of wrong type of film or to overdevelopment.

Check Image Appearance

After this preliminary check-up, which takes only a few seconds, attention can be concentrated on the appearance of the images of any defect. Are these sharply defined and of the contrast one would expect from the type and size of the defects, taking into account the thickness of the weld? Assuming that definition and contrast are satisfactory, the radiograph is ready to be thoroughly examined and interpreted. For this purpose a low-power hand lens is very useful.

Here's what to look for:

These are common defects in butt welded joints . . .



a b c d

(a) Crack in 3/8-inch stainless steel weld, surface ground.

(b) Incomplete root penetration in 3/8-inch stainless steel weld.

(c) Slag inclusions and porosity in 1/2-inch mild steel weld.

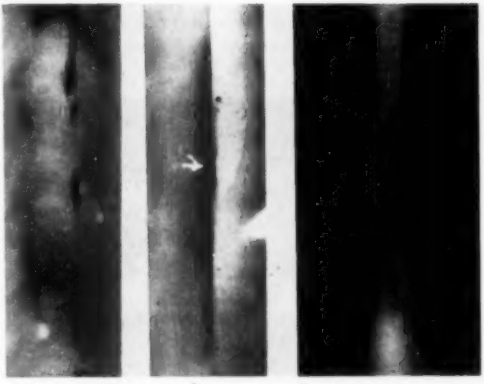
(d) Undercut in 1/2-inch stainless steel weld; one face has been ground.

. . . While these defects are less common.

(a) Straight right edge of slag deposits indicate lack of side fusion.

(b) Edge resulting from poor plate alignment in circumferential 3/8-inch stainless steel weld. Weld was ground flush.

(c) Shrinkage groove in underbead of circumferential weld in light alloy pipe (6-inch diameter and 3/8-inch wall).



a b c

A radiograph will reveal the presence of internal discontinuities in a weld and also of surface imperfections; the latter can usually be seen by visual inspection of the weld if all surfaces are accessible. The first essential in interpreting a radiograph is to know the nature of these defects and surface imperfections, and to be able to recognize the characteristic shadows they produce.

Defects Take Disguises

Such information, however, is little more than an introduction to the subject. All defects will be found in various modifications and disguises. Line defects may be broken up into long or short lengths. Radiographic images may

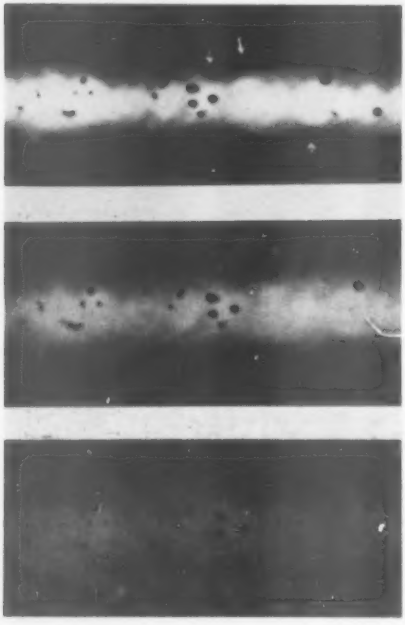
be distinct and well defined, they may be diffuse and scarcely visible, they may be enlarged or distorted and since defects are usually mixed, they must be sorted out and separately identified. The radiographic appearance of a weld also depends on the size and type of joint and on factors which are inherent in the welding method used.

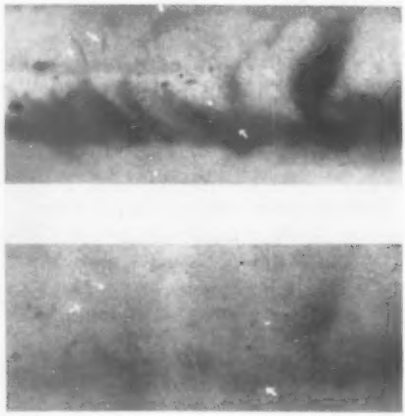
Metal Thickness Is Important

The appearance of a given defect also depends on its position in the metal and on the metal thickness. An image is more distinct, although not necessarily more sharply defined when it is near the surface of the metal adjacent to the film than in other positions. This is an effect of scattered radiation and is not important for the thicknesses considered here. The image of a defect becomes fainter and more diffuse as metal thickness increases, even though the defect remains located in the most

You should recognize these other defects . . .

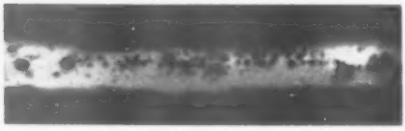
Type of radiation has an effect on radiographic contrast. These butt welds were made in 0.15-inch thick high tensile steel. Fine cracks are indicated by arrows. (top) X-rays 65kV; (center) X-rays 125kV and (bottom) Gamma rays from iridium isotope source.





Metal thickness can effect recording defects. (top) Stainless steel butt weld ½-in. thick has fine cracks indicated by arrow. (bottom) Cracks are less evident in same weld when one-inch thick plate is added to side facing of X-ray tube.

Obliquity of radiation can cause distortion of image detail.



favorable position for detection. The images of small defects gradually disappear as the metal thickness increases, but may be of significance according to their number and distribution, whatever the weld thickness.

Then there is the dependence of the image on the kind of radiation used. The gamma rays from radioisotope sources produce lighter and more diffuse shadows in the radiographs than do X-rays, and therefore defects tend to be underestimated, and may even escape detection. Careful comparison will show that all defects revealed by X-ray can be shown with gamma rays, but that special care is always needed in the viewing and interpretation of gamma radiographs.

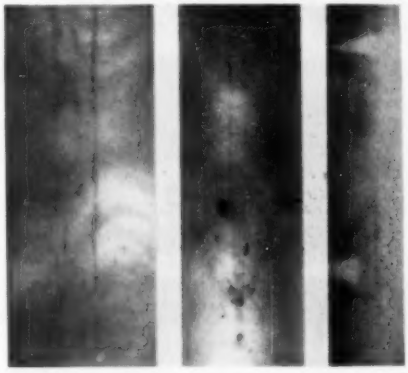
Obliquity Changes Images

Another factor is the changing appearance of the image with changing obliquity of the radiation. The image of a crack looks very different according as it is produced by rays at normal incidence or by rays at oblique incidence.

This change in appearance of the image with changing obliquity of the radiation can be turned to good use in assisting interpretation; for example, in distinguishing between a crack and a capillary pipe. The distortion of the image can, however, be very severe where obliquity is larger, and when unavoidable distortion arises this may be a limiting factor. This is especially so in radiographs of small pipe welds where defects toward the ends of the part examined may become almost unrecognizable.

An additional trouble in such cases is the apparent "twinning" of small defects such as fine porosity or inclusions due to the parallax of the two images one on each coating of the duplitized films. This arises from the fact that the direction of viewing (approximately normal) of the radiograph is different from the direction of the rays which produces the images and the latter thus become out of register.

When a second exposure with a different obliquity is required it can be set up so that the two radiographs form a stereoscopic pair. From these depth of the defect in the metal can be calculated by measurement of the relative image displacement or 3-dimensional viewing can be simulated by examining the films in a stereoscope.



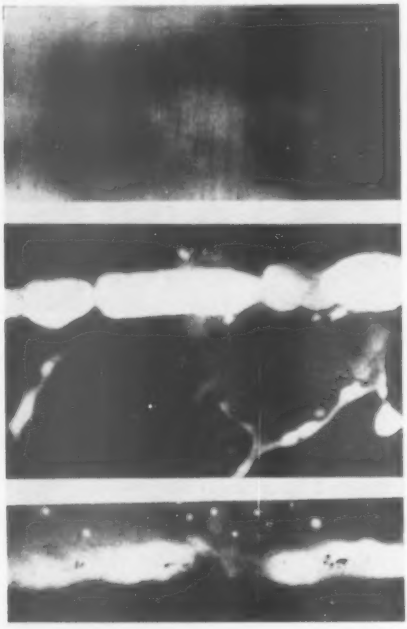
Slag inclusions cause parallel line images called "tramlines." Examples are (left) parallel line inclusions in welded armor plate one-inch thick; (center) line due to slag deposits at root of double-Vee weld and (right) lines due to slag around unfused electrode in fillet weld.

How Was Weld Made?

It is equally important to know something about the manner in which the weld was made, type and thickness of joint, composition of the metal, the weld process used, type and size of electrode, welding current and voltage, method of laying down passes, preheating and annealing. In single Vee welds it should be known whether the root pass has been

cut out and rewelded. Particulars of backing rings, if any, in pipe welds should be known.

When slag is entrapped along both edges of a pass, two parallel line images (tramlines) are produced, separated by the width of the pass. If this occurs near the root of a weld with double Vee preparation the tramlines are closer together and their appearance varies with the presence or absence of a root face or a root gap and with the dimensions of root face and root gap. Poor alignment of plates combined with the absence of root face can usually be diagnosed. Even when plate set-up is correct radiographic appearances vary considerably with the degree of penetration achieved in the root pass. If there is a wide root gap, and no root face, there may be over-penetration producing a bead of circular cross-section imbedded in slag, which gives a very similar radiographic appearance to that of electrode laid in the joint and welded over. In fact, if such an electrode is well fused during subsequent welding it is almost impossible to distinguish between the two conditions.



Other imperfections in welds include (top) transverse surface scratches produced by coarse grinding wheel; (center) splash on inner surface of circumferential weld tank and (bottom) spatter.

Identification Of Tramlines

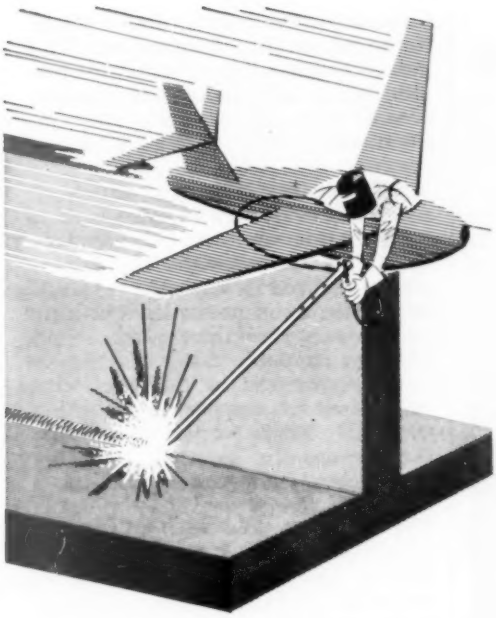
Tramlines which do not correspond to any known internal defect may appear occasionally in radiograph of stainless steel welds. The cause of these is not fully understood. Although they are believed to be associated with a columnar crystal structure in the deposited metals. These tramlines are readily distinguishable from incomplete penetration by their appearance which is very faint and diffuse.

Slag inclusions along the side of a Vee groove are sometimes associated with lack of side fusion. This condition is revealed by the straightness of the outer edge of the inclusion. Poor alignment of parts may be disclosed in pipe welds and circumferential welds if the outer surface has been ground flush after welding. The thickness of the upstanding plate is reduced in surface finishing by the amount of the upstand and this gives rise to a dark shadow down one side of the radiograph with a sharp line of demarcation.

Laminations Cause Defects

Another line defect is the capillary pipe which usually arises from lamination in the parent plate. The pipe runs along the side of the welding groove more or less parallel to the plate surface and is

(Turn to Page 64)



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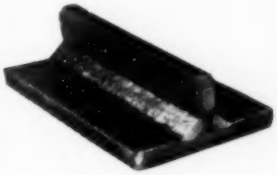

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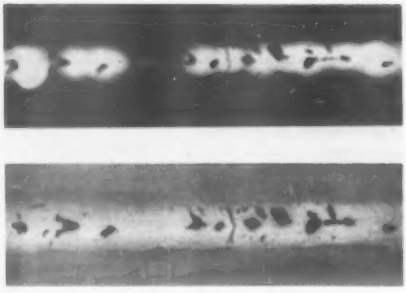
formed by the action of the welding heat on the lamination. The defect is almost impossible to repair, since the lamination continues to open up at each attempt. Fortunately, the defect is not a common one.

Another imperfection which is readily revealed in a radiograph is excessive or very irregular underbead. In some cases the weld metal may run through a joint and splash on to the opposite wall of a pipe weld or a circumferential seam. Another imperfection, spatter, is easily recognized by the small circular shadows appearing alongside the weld. These imperfection have significance in pointing out incorrect welding procedures.

What About Weld Grinding?

Surface grinding is a much discussed subject. Where surface finishing has been done with a coarse wheel, scratches may be deep enough to show in the radiograph. Where build-up is intended to provide a reinforcement of the weld, its removal may not be permissible, but where its purpose is to refine the grain there would appear to be no objection to its re-



Grinding has an effect on the clarity of image details. (top) Butt weld in steel plates, as welded. (bottom) Same weld after surface grinding. Note changes in appearance of cracks.

moval after this purpose has been achieved. In doing this, any subsurface defect in the reinforcement is removed and the remaining smooth surface results in a clearer radiograph, thus simplifying interpretation.

One of the most serious defects of smaller dimension is intercrystalline cracking, which occurs mainly in stainless steel welds. These cracks, being both fine and shallow, produce correspondingly fine images which can be easily overlooked. Their mottled appearance indicates a coarse grain and should be regarded as a danger signal calling for great care in viewing.

Small Slag Inclusions

Another defect which seems to occur mainly in high alloy and stainless steels is the small slag inclusion with fine cracks radiating from it. The radiographic image of this defect resembles that of a beetle and the defect is generally situated below the metal surface. The macro-print of this defect shows the potential cleavage plane through the throat arising from the junction of differently oriented dendrites. The radiograph does not indicate the presence of an actual discontinuity at this junction, but in thick submerged arc welds a definite straight line hot crack may develop along this plane.

The radiographic technique for the examination of pipe welds differs somewhat from that used with large circumferential welds and can affect interpretation. The technique used must be known; for example, whether X-rays or gamma rays have been employed, whether there has been single wall or double wall penetration by the rays and whether the penetrameter has been placed on the film side or the source side of the weld. It is also important to know whether a back-

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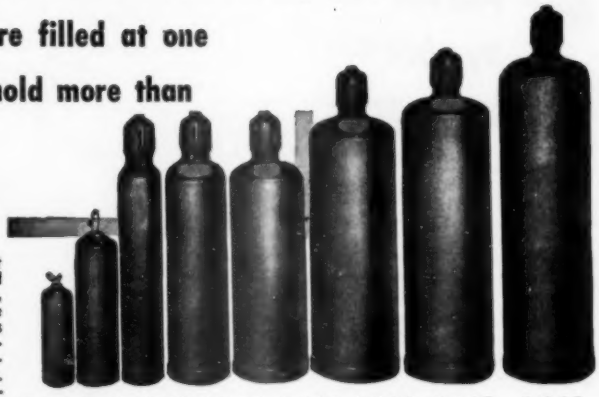

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ing ring has been used, since characteristic defects associated with them may be present. In small diameter pipe weld, where there is no backing ring, the appearance of the underbead is a good indication as to whether satisfactory penetration has been achieved. In this case, grinding of the outer surface increases the clarity of radiograph considerably.

Fillet Weld Inspection

Fillet welds, and welded flanges and branches, call for special care in interpretation. Detailed particulars of the radiographic technique must be available, together with drawings showing the direction in which the shots have been made. Lack of side fusion is almost impossible to detect in many types of fillet welds and it's fortunate that defects in these welds tend to be located mainly at the root. This being the case, it is a matter of simple geometry to determine where the root defect will appear.

A difficulty with deep penetration welds is that the image of any unfused gap may overlap the root weld, so that it may be difficult to say with certainty whether there is any root cracking present; variations in the width of the gap can be clearly shown, but it is difficult to interpret any superimposed shadows.

Interpretation does not end when defects are located. Thought must be given to the acceptability of the weld and to what faults in welding techniques caused them. This is the job of the welding supervisor rather than that of the radiographer.

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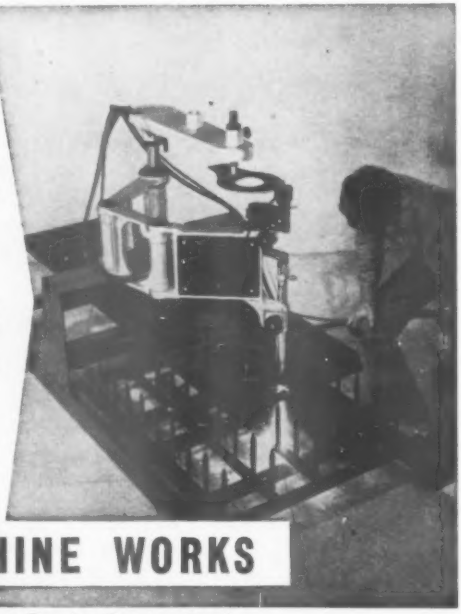

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RESISTANCE WELDING

(Continued from Page 46)

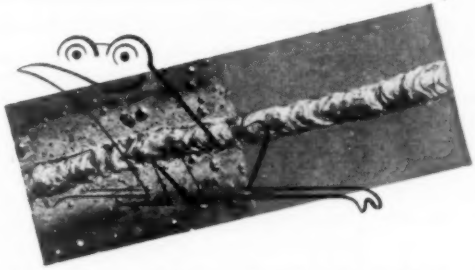
to a new approach to some of the many problems involved in single-phase resistance welding of aluminum with conventional alternating-current machines. Eliminating pick up is particularly significant in spot welding aluminum and an important aid to quality work.

Slope control is in effect a variable resistor connected in series with the heat control potentiometer to reduce welding current during the first few cycles of the weld. Such equipment consists of auxiliary controls used in conjunction with the standard control panel. The required variation in resistance is obtained by varying the bias voltage of two GL-502A Thyratrons connected in inverse parallel.

Welding procedures have been established for use with this auxiliary equipment to produce spot welds whose strength is equal to or greater than called for in the Air Force-Navy Aeronautical Specifications AN-W-30. These procedures are shown in Table III. These strengths can easily be obtained with conventional A-C welders equipped with slope control and standard electronic timing.

For further information write to the Editor, INDUSTRY and WELDING Magazine, 1240 Ontario St., Cleveland 13, Ohio, or circle number 200 on the Reader Service Card enclosed in this issue.

See Page 18 for easy index to welding products



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Submerged Arc Welding . . .

(From Page 40)

Idlers for crawler tractors are among other parts rebuilt to great advantage by automatic submerged arc welding. Procedure in welding is substantially the same as that described for rollers except that welding is done in successive layers without stops for cooling between layers. In most cases, the rebuilding to original size costs about one-third as much as a new idler and the rebuild will last about 50 percent longer than a new part.

The same procedures can also apply to shovel rollers, idlers, sheaves and turn-table rollers.

Rebuild Flat Surfaces

Foregoing examples apply only to building up surfaces of rotation, but similar work has to be done on flat surfaces of what are termed crawler "track rails". These "rails" are made up from links subjected to wear on flat surfaces against which rollers and idlers bear. Servicing, including the build-up of worn surfaces, is necessarily an expensive though essential operation. When done by automatic welding, however, costs run about 46 percent as much as replacement would cost.

As tracks are articulated, being made from links pivoted to each other, such tracks can be laid flat although in service they run over sprockets and idlers and in contact with rollers. There is, between the bearing surface of each link and that of the next link to which it is pivoted, a space or valley. Thus, although resurfacing must be done on longitudinal surfaces extending the length of the track, the surfaces are not continuous but are interrupted by the valleys above each pivot.

Rebuild Track Rails

Track rails run up to 32-feet in assembled over-all length. To handle them, the machine shown in Figures 4 and 5 was built. It includes an automatic head shown close up in Figure 4, supported from a carriage arranged for traversing along a beam track over the full 34 foot length, the beam being adjustable for height. On the carriage is the control panel and the reel for electrode wire, but no flux hopper save that of the head itself.

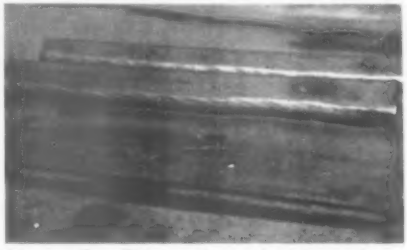

Figure 7—Gripper lugs that have been welded automatically to the plates of this track in the same machine shown in Figures 4 and 5. Welds are made in one pass on each side of several plates placed in line.

Below the carriage is a trough-like bed whose bottom is a ¾-inch steel plate welded to stiffening web plates and the latter to a flange. These provide a rigid structure, Figure 5. To this bed, the assembled track rail is bolted parallel to the carriage rail. Below the bed are pedestal supports on which the trough is pivoted.

Continuous Welds

Servicing of track rails is done as follows: (1) Track plates are removed. (2) Pivot pins and bushings are removed from links. (3) Pins are turned or replaced or new pins and bushings are installed. (4) This assembly is then placed on the bed of the machine, Figure 5, and is bolted down in proper alignment. (5) Valleys at joints where welds are to come are filled

(Continued on Page 70)

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(temporarily) with metal by hand welding, to afford straight and continuous surfaces along which build-up by automatic welding is to be done. Without this, the welds would be intermittent and so would lack the uniformity of continuous welds.

(6) To avoid the need for continuous and rapid flux feed from a moving hopper, the entire remaining space in the trough is filled with granular L-760 flux, submerging the track. Small amounts of flux can be fed from the hopper under hand control, however, if needed at intervals to submerge the arc. (7) After adjusting the head vertically (by motor driven screws controlled from the carriage) and transversely to start the weld at one end of the rail, the $\frac{3}{16}$-inch electrode wire is fed down. Welding is thus started and proceeds at 35-inches a minute over the whole length of the track, laying down a bead about ⅛-inch high and ½-inch wide per pass.

Operator Follows Head

(8) When this bead is completed, the head is adjusted transversely and lays down the adjacent bead with the head traveling in reverse direction. Successive traverses continue until the whole of the surface to be built up is covered. A succeeding layer or layers are built up in the same way if needed to bring the surfaces to required height. An operator follows the head as it advances and uses a hammer to chip off flux as the weld cools. He also sees that flux already in the trough flows back to cover the arc on the next pass.

(9) After top surfaces of the track are built up to original height, the trough is tilted about 30 degrees and side surfaces of the track are built up to restore the original size. If required, this includes a

second tilting of 30 degrees to the opposite side. (10) When the build-up is completed, the head is raised and the trough is inverted to dump the flux onto the floor. This flux is subsequently shoveled up, sifted to remove large fused particles, and is then reused.

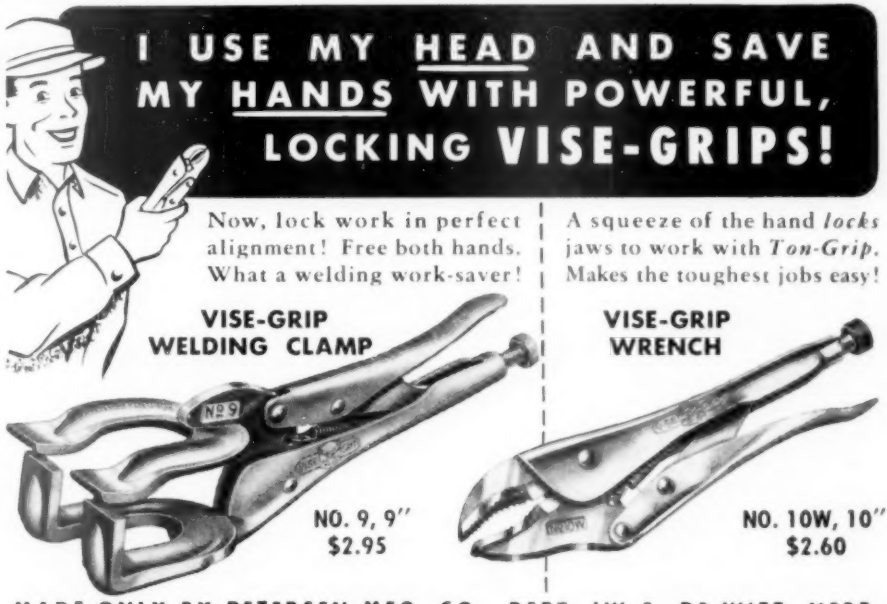
Flame Cutting Completes Job

(11) Having completed the automatic welding, the track is unbolted and is removed to a cutting table. There, an operator uses an oxy-acetylene flame to cut out the metal welded into valleys at joints between links. This leaves the track ready for use as in Figure 6. No grinding is required because with automatic welding in a precision machine, the build-up is uniform and is controlled for uniform height.

Wire used in track build-up is $\frac{5}{32}$ or $\frac{3}{16}$-inches in diameter and provides highly wear resistant surfaces. These make the track more resistant to wear than when new, although the repairs cost the customer an average of about 40 percent of that for a new track.

Compressed Gases Appoints Cleveland Sales Representative

Appointment of Bob Hanson as Cleveland, Ohio, area sales representative of the Compressed Gases Inc. of Ohio, has been made by R. William Metzger, manager. Mr. Hobson was formerly employed by the National Cash Register Co.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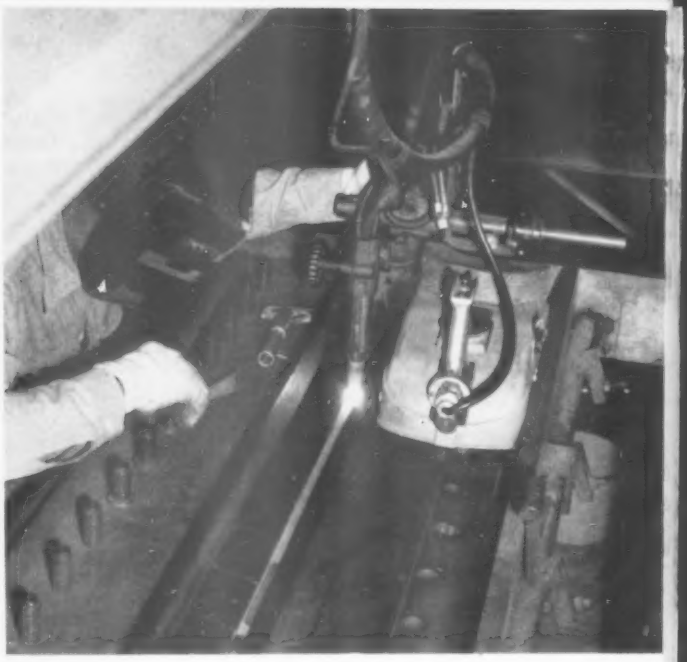


Speeding along at 30 ipm, an automatic inert arc welding machine fuses the seam of a stainless steel tail-pipe for a General Electric jet engine. Ryan uses specially built-in fixtures for straight-line work.

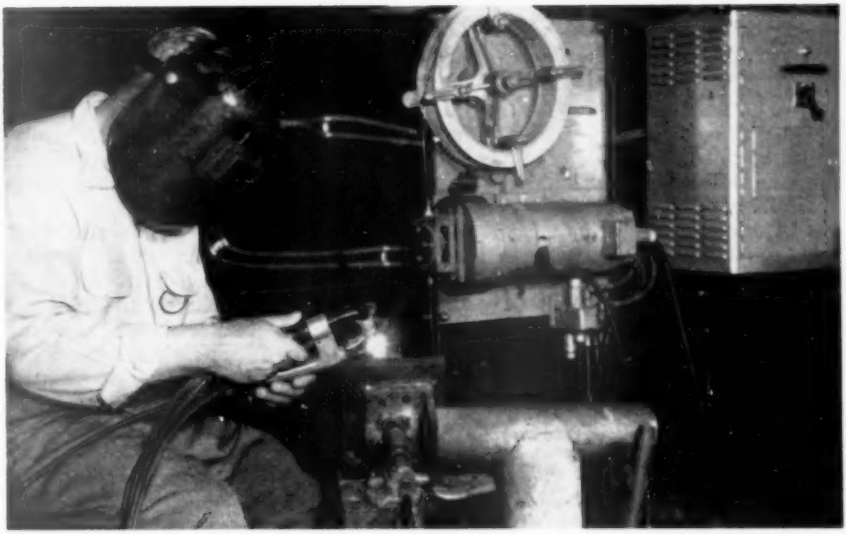
Here's How Ryan Aircraft Speeds

A REVOLUTION in fusion welding has taken place at Ryan. During World War II, Ryan "stitched" thousands of aircraft and engine components together with acetylene gas, atomic hydrogen and metallic arc welding. Today, only metallic arc remains as a member of this fusion welding team.

The big switch has been to a newer method—inert gas-shielded arc welding, and Ryan has converted all acetylene gas and atomic hydrogen production facilities to this technique. Among the first to harness the advantages of new welding processes in the past, Ryan has been similarly progressive in the use of inert gas-shielded welding. Ryan's 169 fusion welding stations consume *more than two million cubic feet of inert gas a year* to make it one of the nation's largest users of this process.

Gas Protects Weld Metal

Inert gas-shielded tungsten arc welding is similar to atomic hydrogen welding in that it makes use of a gas for protecting the hot metal. Unlike the atomic hydrogen process, the arc is maintained between a single tungsten electrode and the base metal instead of between two electrodes. Also, the blanketing gas, which flows in a low velocity stream around the electrode, con-



Newest welding technique is used to weld exhaust system parts. Combining speed of automatic welding with control of manual methods, new machine feeds wire into the arc between motor-driven rolls.

Fusion Welding With Inert Arc Process

sists of an inert, monatomic gas rather than hydrogen. This gas serves only as a shielding agent and does not dissociate to release additional heat as hydrogen does.

Eliminate Fluxes

The outstanding advantages of inert arc welding are elimination of flux, increased speed, improved quality and minimized weld finishing. By eliminating the need for flux, this process provided the first successful means for fusion welding aluminum and magnesium alloys, which are attacked by the corrosive elements of fluxes. Without flux, flux entrapment is avoided.

Inert-arc welding is fast. Full penetration with speeds as high as 40-inches per minute can be attained on $\frac{1}{16}$-in. stock. The pinpoint concentration of heat which the process provides, coupled with its speed, makes it exceptionally useful for welding the stainless steels which Ryan fabricates. These alloys are subject to carbide precipitation and loss of corrosion resistance when exposed to sustained welding temperatures. Also, the stabilizing elements of columbium and titanium, contained in stabilized grades of stainless steel, may be boiled away if the metals are held at welding temperatures for prolonged periods.

Inert Arc Welding Leads The Way . . .

The inert-arc is efficient for welding practically all commercial metals including aluminum, magnesium, copper, titanium, stainless steels, nickel and cobalt base alloys, carbon steels, cast iron, lead and silver. It produces X-ray quality welds which possess good tensile strength, elongation and impact resistance. Its high speed makes it ideal for welding light gauge materials because it reduces warpage and provides attractive appearing welds. At Ryan, the process is used to weld gauge thicknesses running from .035 to two sheets of .156-in.

No Splash or Spatter

Due to its inherent characteristics and the stabilizing effect of the blanketing gas, the inert-arc weld deposit is laid down in a smooth bead without spatter or splash. Consequently, the weld seldom requires the grinding or finishing operations which are associated with other fusion welding operations. This is a distinct advantage in reducing labor costs and production time.

Ryan rolls all inert-arc butt welds in austenitic steels, which are accomplished without the addition of filler wire, in Ryan-designed seam rollers. Especially built for this work, the machines flatten the weld seam between two steel rolls under heavy pressure. This cold works the weld to refine its structure and eliminates the notch effect caused by the tendency of the metal to sag slightly when molten.

All exhaust systems are fabricated by inert-arc welding at Ryan. Covering about 80 percent of the industry's requirements, these structures serve such prominent aircraft as Douglas DC-6 and C-124 Globemaster II transports. Ryan manifolds are also used on General Patton M-47 and M-48 medium tank engines. These structures are fabricated from Inconel, and stain-

Inert arc welded seams are flattened and refined in one-tenth the time with seam rollers which also eliminate the notch effect caused by the tendency of the metal to sag slightly when molten.

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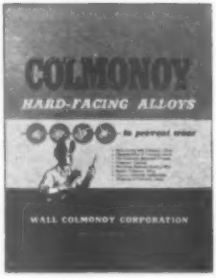

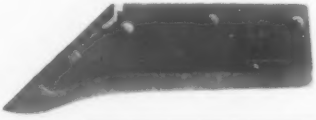

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less steel of 19-9DL, 347, 321 and 310 types. Gauges run from .042 to .095-in.

Because of the complex, irregular design of these exhaust systems, they are welded manually. Inert-arc welding is well adapted to this work because it involves light weight equipment with some torches weighing only three ounces. For this work Ryan has established one of the most modern welding areas in the aircraft industry with 29 integrated welding booths in one location. All motor-generators are installed overhead and a cascade system is used to supply argon gas and cooling water. Gas and water are automatically controlled by Ryan-devised timers.

For these tasks, DC straight polarity current, ranging from 75 to 100 amperes, is used. Material thicknesses vary in the designs and the Ryan welder uses a Mullenbach foot control rheostat to vary the welding voltage as he goes. This allows the welder to attain better control of welding conditions and produce a finer weld result.

Instead of adding filler metal to these welds, an upstanding flange is formed at the seams and melted down by the heat of the arc.

Electronic "eye" tells "time" on Ryan's new welding machine which has squeezed the time for welding an exhaust system nipple from 3 minutes to only 7 seconds. Machine employs a fast-shift carriage and automatic operation.

Weld Jet Components

Ryan also uses manual inert-arc methods to weld a wide variety of detailed components for General Electric, Westinghouse and Pratt and Whitney jet engines. These run the gamut of special alloys such as Inconel, Inconel X and W, Stellite 25, N-155, Discalloy and the stainless steels. In jet engine work, an added requirement is made. Dimensions of the weld are specified and tolerances in width must be closely controlled.

In addition to the high temperature alloys, Ryan manually welds many aluminum alloys with this process. Typical example of this work is the welding of huge fuel tank rings, 4-feet in diameter. These rings serve as splice joints for the largest external fuel tanks ever built for aircraft. They are fabricated from 61S aluminum alloy. Ryan welds them with high frequency stabilized AC current, using between 75 and 150 amperes, depending upon thicknesses encountered. These gauges vary from .050 to .072-in. Inert-arc torches used are exactly the same as those employed in welding stainless steels.

Ryan has constructed a mobile machine which incorporates all of the necessary elements for inert-arc spotwelding — DC generator, argon gas supply, 40-gallon water

tank and pump. With this device, spotwelding facility can be quickly moved along the production lines to the work. Ryan is using the new machine to spotweld Fairchild C-119B exhaust hoods and machined rings in assembly jigs. After these parts are carefully fitted together and spotwelded, they are seam welded in resistance welding machines. The gun type torch produces such a smooth spotweld that

Inert arc welded into smooth barrels of Inconel W, these afterburners serve as "flamethrowers" for General Electric jet engines.

no finishing is necessary in order to run these parts between the wheel electrodes of the resistance welders.

In addition to the large amounts of manual welding which Ryan performs, substantial quantities of automatic inert-arc are accomplished. Automatic machines are used on all straight line, butt welding jobs, both in aluminum alloys and the stainless steels. For instance, Ryan builds afterburners, tail-pipes and exhaust cones for General Electric J-47 jet engines in this way. These structures are fabricated from stainless steels and other high temperature alloys in thicknesses from .040 to .075-in. Ryan designs and builds special fixtures to hold the parts in exact alignment while the automatic welding head traverses their longitudinal or circumferential seams. DC straight polarity current is used and welding speeds up to 30-inches per minute are attained. A number of machines are equipped with selenium-type rectifiers which convert AC current from the line into DC and eliminate the motor generator.

All of the longitudinal seams in Ryan's huge fuel tanks are welded with automatic inert-arc machines. These large sections are butt-welded with filler wire automatically fed into the seam. The alloy is 61S aluminum and gauge thicknesses run from .051 to .072-in. With the new type "floating" head which automatically maintains a constant length arc, it is possible to weld contoured surfaces. Ryan has built such a machine and uses it to weld the irregular contours of after-burner nozzles, automatically.

Semi-Automatic Inert Arc Welding

One of the newest devices, which Ryan is using, is the semiautomatic inert-arc welder. This is a manually operated torch which automatically feeds filler wire into the arc. All the operator has to do is set the current and wire feed and guide the work. When the arc is struck, the wire is automatically fed between rolls into the weld. Its movement propels the torch. Hand welding speeds as high as 80-inches per minute have been reached with this new method. Combining the advantages of manual guidance with automatic control of arc length, wire feed and travel, the

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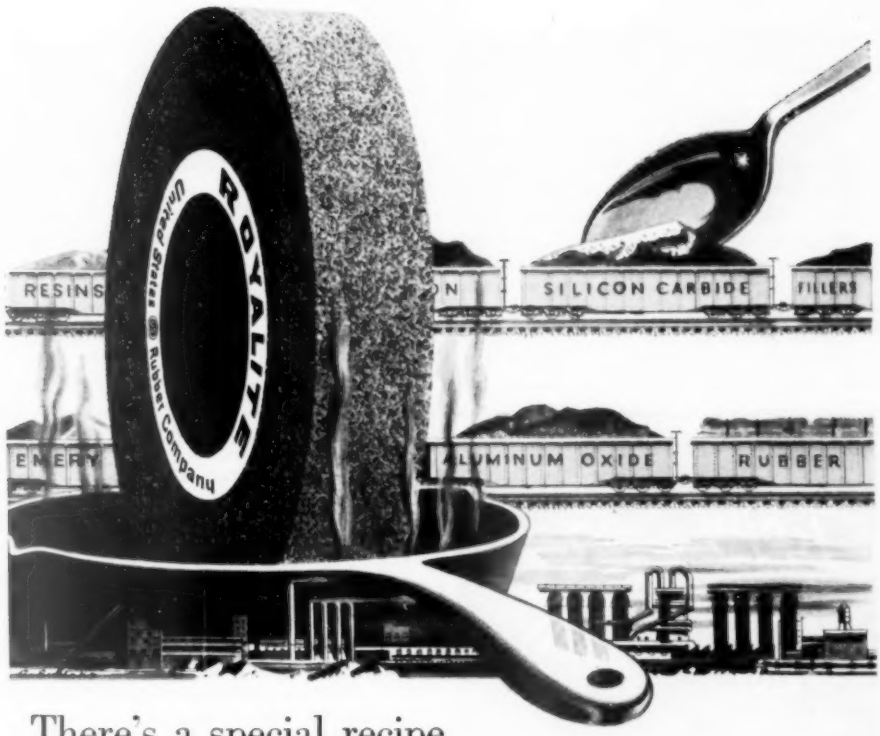

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technique is excellent for irregular components. It is water-cooled and capable of handling up to 300 amperes capacity.

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This method also uses a consumable wire electrode which is fed at high speed through a blanket of argon gas and melted into the weld area. It produces high quality welds with deep penetration and lends itself to full automatic operation, and can handle twice the current densities which are used manually.

Ryan uses the semi-automatic process to weld exhaust system nipples to port flanges and join ball sections to exhaust tubes. These components are about 2½-in. in diameter and are welded circumferentially. For welding the nipples to the flanges, Ryan has de-

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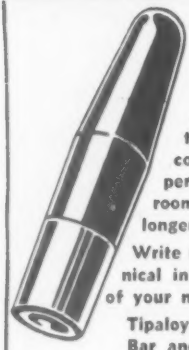

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The operational sequence goes like this: the operator places a nipple on one of the revolving holders and presses the foot pedal. The carriage shifts to bring the nipple under the electrode. As it moves, the carriage trips a microswitch which starts the welding cycle and the arc strikes. Current used is 250 amperes, reverse polarity DC. The light of the arc plays upon a photoelectric cell which trips a relay that automatically times the welding run and switches off the arc. All the operator has to do is shift the carriage and replace the nipples. With two holders, one nipple is being welded while the other one is being replaced by the operator.

Formerly it required three minutes of manual welding plus finishing to do one of these nipples. With the new machine it takes only 7 seconds to get a sound, clean weld which requires no cleaning or finishing labor. A normal production for this machine is 800 nipples per 8-hour shift although as many as 1200 have been accomplished in that period.

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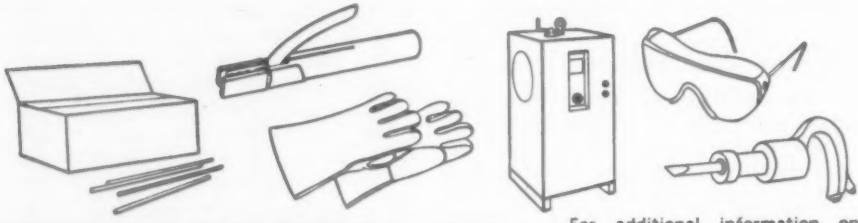

new products

For additional information on the products appearing on this and the following pages, mark the key number of the item on the card bound into this issue. Drop the card in the mail—no postage is required.

Tweezer Type Soldering Machine

Joyal Products, Inc. recently announced that its 250 W. AN Connector soldering machine is now being made with soldering tweezers as well as the regular soldering electrodes. This gives equipment added versatility for soldering small parts on a production basis.

Tweezers are fibre-glass insulated, and electrodes, which can be shaped to fit any type of operation, can be replaced at extremely low cost. Company officials have stated that it has been estimated that one machine with one operator can turn out the work formerly produced by 2½ operators with soldering irons.

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Powdered Welding Flux

A powdered flux for use in the welding of aluminum bronze sheet and plate has been developed by Ampco Metal, Inc. It may be used with the inert gas processes and bare filler rods in all grades.

Ampco engineers state that the flux insures removal of oxides from weld metal and reduces surface tehsion allowing deposit to flow into side walls more uniformly giving a sounder deposit of improved appearance. Full penetration can be secured in straight butt joints at lower welding currents and preheats.

Flux is mixed with an alcohol and painted on all surfaces of the joint to be welded. It may also be applied to the bare filler rod.

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New Principle In Electrodes

A new type of electrode based on a principle that is different than any other available electrode is the "Easyarc 12" now being marketed by the Air Reduction Sales Co. Company engineers state that the new electrode used for the welding of mild steel, offers welding speeds which double those of conventional electrodes.

Increased speed is achieved through the addition of a large amount of powdered metal into the electrode coating. This metal changes the arc action so that welds can be made by dragging electrode in contact with the plate. Because metal powder becomes part of the weld bead, faster welding is achieved.

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High Frequency Control For Inert Arc Welding

The Viking Division of the Progressive Welder Sales Co., is now marketing their Rad-Arc-Trol, an arc control combination which features a remote control switch on the inert arc torch offering operator finger tip control of gas flow and high frequency current.

Company engineers state that positive control of weld for the inert arc process is assured, for: Operator presses control switch on torch starting gas flow and high frequency; arc is started without touching tungsten to work; after completion of work operator releases control button, shutting off gas and high frequency.

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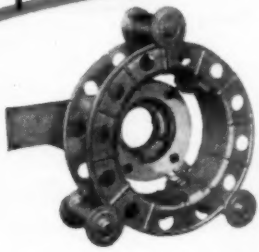
The Reid-Avery type 4R automatic head and control originally designed for Raco composite type A, may be used with equal success for lightly coated open arc or for submerged arc welding.

Raco composite type A heavy coated automatic (open arc) electrodes, a "Reid-Avery" first, can be furnished in all mild steel, low alloy high tensile, low hydrogen, hard surfacing and stainless steel grades.

Mild steel, alloy steel, stainless steel, aluminum and phosphor bronze wire are available on expendable wooden spools or in layer wound coils for gas shielded arc welding.

The Raco "free wheeling" reels are especially designed for high speed automatic machines. The ball bearing trunnions enclose the coil so there is no over-run or loose strands and larger coils can be used. Changing coils is a matter of only a few seconds and no tools are required. Available in 12, 14, 25 and 36 inch sizes, for any weight from 50 to 200 lbs.



The Raco coils of wire for submerged arc welding have long been known for their uniform high quality and convenient, easy to handle package. Special attention is paid to the accurate weight, lay and temper of the wire so that the wire will accurately follow a seam. Available in mild steel, alloy steel and stainless steel.

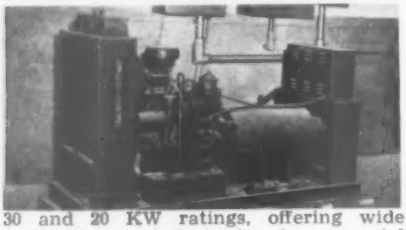
Since 1919 Reid-Avery Company has specialized in the manufacture of all types of welding electrodes and wire. The large modern plant in Baltimore is equipped for wire drawing, annealing, pickling, coating, cutting, winding and packaging. Every phase of welding electrode and wire production is completely controlled from start to finish. You can be assured of uniform high quality and the best possible deliveries.

The REID-AVERY COMPANY
INCORPORATED
DUNDALK · BALTIMORE 22 · MARYLAND
SINCE 1919 PRODUCERS OF ARC WELDING ELECTRODES AND WELDING RODS

Circle No. 50 on Reader Service Card.

Packaged Electric Power Plant

The Ready-Power Co. recently introduced a new generator series powered by Chrysler industrial engines. Designed to deliver full rated power with maximum efficiency and economy, the new Ready-Power series includes three sizes of 50,



30 and 20 KW ratings, offering wide applications in industrial and commercial fields.

Each unit is a complete, packaged electric power generating plant, ready for operation and designed for either standby or continuous service. All controls for both engine and generator are located in single, simplified control cabinet.

Circle No. 134 on Reader Service Card.

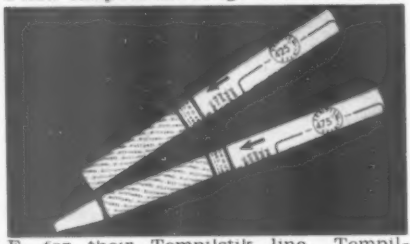
Build-Up Rod

The Rankin Mfg. Co. has announced an improvement in their Ranite Type "A" build-up welding rod. Company engineers state that deposition rate has been increased twenty percent when run on straight polarity. This faster deposition rate makes rod more adaptable to high speed build up under harder rods on such applications as crusher rolls and mantles. Because of this speed, less heat is induced into the parent metal, avoiding stress and pull.

Circle No. 136 on Reader Service Card.

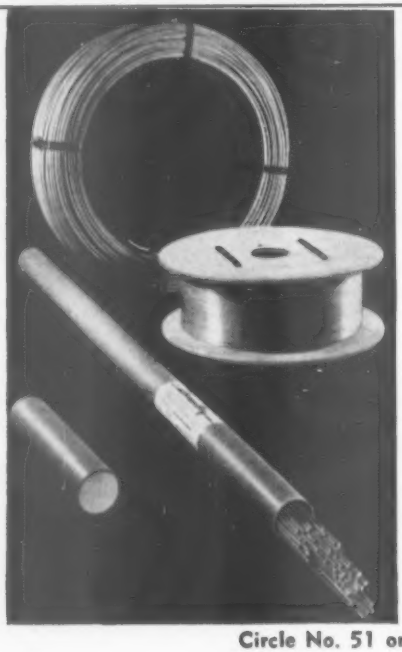
New Range For Temperature Indicating Crayons

The Tempil Corp. recently announced a new temperature range of 425° and 475°



F. for their Tempilstik line. Tempilstiks are now available in the range 113° to 400° F. in 12½° intervals, in the range 400° to 500° F. in 25° F. steps, and in 50° F. intervals from 600° to 2000° F.

Circle No. 17 on Reader Service Card.



FOR QUALITY WELDMENTS USE

***Drawalloy* CORPORATION**

QUALITY CONTROLLED

STAINLESS STEEL

Welding Wire

- **available in Spools, Coils and Lengths**
- **for Automatic and Semi-Automatic gas and inert arc welding**

Welding wire by Drawalloy is made to an exacting high standard... a high standard established by long-experienced welding men who know welding wire and how it must work. Set-ups for automatic and semi-automatic welding take more time than regular welding. That's why you want to be sure of satisfaction *before* you start. This *reliable* wire is weld-tested to give the best results every time. Write today for complete information and prices.

WELDING SUPPLY DISTRIBUTORS: Get prompt delivery on all sizes and grades of stainless and tool steel wire for gas and inert arc welding.

Drawalloy

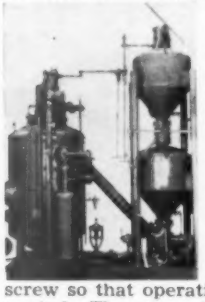
CORPORATION

Lincoln Highway at Alloy Street • York 11, Pennsylvania

Circle No. 51 on Reader Service Card.

Acetylene Generators

NA-7 acetylene generators developed and now being introduced by the Linde Air Products Co., produce high quality acetylene at rates up to 9,000 cu. ft. per hour. Generating just enough gas to meet demands from consuming equipment, even though demands may fluctuate over a wide range, units have two hoppers, one above the other, which supply carbide to the feed screw so that operations are never interrupted. The upper hopper serves to replenish the carbide supply in the lower. It can be recharged while the lower hopper continues to supply carbide to the generating chamber.



Circle No. 137 on Reader Service Card.

Portable Hardness Tester

A pocket-sized hardness tester giving accurate, direct readings thereby eliminating guess work and trial and error methods of determining proper hard facing materials, is now being marketed by the Industrial Overlay Metals, Inc.

Tester, which can be a valuable addition to your present testing equipment, consists of: Carrying case; indentor; master test block and microscope with direct readings.

Circle No. 138 on Reader Service Card.

DESIGNED AND BUILT TO DO THE JOB!

THE WEBB PLATE BENDING ROLL

Built in Two Types, Initial Pinch and Pyramid.
Complete Range of Sizes and Models.

Manufacturers of Plate Rolls, Combination Punch & Shears
Industrial Weighing Equipment

Since 1881

THE WEBB CORP.

WEBB CITY, MO.

Webb Plate Bending Rolls are designed and built for the forming of cylindrical shapes from rolled steel plate with greater speed and accuracy for high quality production.

All Webb Rolls are backed by continuous progress in the development of industrial machinery since 1881.

Write for catalog.

Prompt Delivery on Standard Sizes

Circle No. 52 on Reader Service Card.

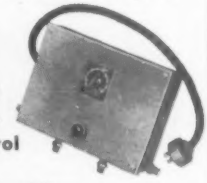
2 IMPORTANT AIDS FOR WELDERS!

USE YOUR FOOT instead of your head!

Mullenbach
ARCTROL
Makes all welding easier

Adjust heat *WHERE* you weld, *WHILE* you weld! Simply depress foot pedal until exact voltage is delivered. Portable, saves trips to welder; selects correct heat for each job variation. Does not affect range of welder—a *necessity* on precision welding, a *tremendous* advantage on production work. *Available for most makes of D.C. welders. Free circular, state welder make and model.*

Mullenbach
GASTROL
Automatic gas-water control for inert gas (Heliarc) welding



- Saves up to 50% of argon or helium gas by limiting flow to welding and cooling periods!
- Increases tungsten electrode life!
- Saves operator's time and eliminates human forgetfulness!
- Makes better welds! Prevents condensation causing contaminated welds by stopping water flow during off-welding periods!
- Low in cost!

Ask for folder

Mullenbach
Electrical Manufacturing Co.
2300 East 27th Street • Los Angeles 58, California
Circle No. 53 on Reader Service Card.

Featherweight Safety Goggles

For semi-hazardous operations such as spot welding, buffing, wood working, inspection and hand tool operation, are the new Welsh guard safety goggles now

being marketed by the Welsh Mfg. Co. Available with clear or green curved lenses, these economically priced goggles, have acetate frame with full vision spatula temples. Since no metal parts touch skin, comfort is assured.

Circle No. 139 on Reader Service Card.

400 Ampere D.C. Rectifier Type Welder

A new 400 amp., three phase, D.C. rectifier type welder with a 60 percent duty cycle has been announced by the

General Electric Co.'s Welding Department.

Called the G.E. Type WR40A, welder can be equipped to operate on a two phase power and has a current welding range of 70 to 500 amperes. It can be

used with a variety of electrode sizes for repair, maintenance and construction work.

According to company engineers, the quiet operating welder makes it easy for operators to achieve current adjustments by means of a stepless current control. They also state that instant arc welding is assured since there is no inductive time lag usually found in motor generator sets. Because of the high current produced by the six parallel path selenium rectifiers in the new unit, stable arcs and resulting smooth welds are possible.

Circle No. 140 on Reader Service Card.

Pocket Sized Drafting Device

A new device combining the functions of T-square, triangles, straight edge, scales and protractor, or drafting machine, in one simple unit without adjustments or additional parts has been announced by Pickett and Eckel, Inc. The Paraline weighs less than 4 ounces and may be used on any flat surface such as table or desk for ordinary drawings or to speed up detail work on large drawings where drafting machine or T-square are used.

Circle No. 141 on Reader Service Card.

Soldering Guns Handle Up To 275 Watts

Increased power up to 275 watts is one of the features of the redesigned Weller soldering guns, manufactured by the Weller Electric Corp. Model 550 is said to be capable of making quick work of

countless shop, maintenance or laboratory soldering jobs, combining adequate heating capacity with accurate finger tip control.

An exclusive tip fastening arrangement assures full, constant heat eliminating contact resistance and oxidation, and dual heat feature affords extra capacity where high heat is required providing longer tip life.

Circle No. 142 on Reader Service Card.

the complete outfit for all medium and light welding

Yes, the MECO Money Maker is especially recommended to the production and repair shop, where intermediate and light welding is a daily requirement. It is also available with cutting attachment for quick conversion for outstanding cutting service.

Send for your FREE Catalog No. 150

Ask Your MECO Distributor About the Money Maker Outfit.

Meco

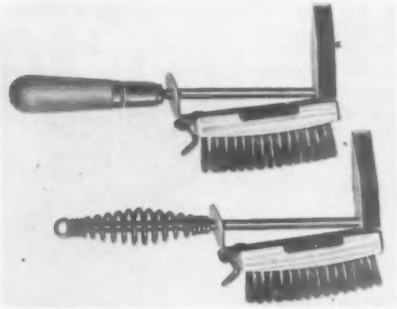
Modern Engineering CO., Inc.

3401 PINE BLVD. ST. LOUIS 3, MO.

Circle No. 54 on Reader Service Card.

Improved Weld Cleaning Tools

The Atlas Welding Accessories Co., has redesigned its standard models A and



AW "Dual Tools," making them more durable and easier to use. Brush is now pitched at an angle to the handle making it easier to apply whole surface to the weld without scraping knuckles along the work. Frame for brush and handle is of heavier gauge steel and ribbed for additional rigidity. Chisel is welded to the frame and handle instead of riveted as in the past.

Double tension spring that secures brush in the frame is so designed that simply by pulling it back, brush can be replaced or reversed.

Circle No. 14 on Reader Service Card.

Offset Forming Machines

A newly designed line of offset forming machines have been announced by the Reed Engineering Co. Machines are used for joggling or offsetting end of tank shells and pipes for assembly of welding heads or other shells. Joint produced provides excellent back up for

M 38
CUTTING TORCH

Famous
for
ruggedness
efficiency
balance
flashback resistance

. . . using all fuel gases, on every type of hand cutting job. Choice of heads, levers, lengths. See your K-G Distributor, or write to *The K-G Equipment Co. (Inc.), Dept. B, 1744 Lehigh St., Allentown, Pa.*

K-G

DISTRIBUTORS!
Valuable franchises available.
Write for details.

Welding & Cutting Equipment

Circle No. 55 on Reader Service Card.

POWERFUL...RUGGED..
HIGH SPEED...

Since 1926

Nedco
Grinding •
Cutting •
Sanding •
and Polishing Machines

Especially designed for welding shops, foundries, machine shops, etc.

Nedco heavy duty portable electric tools are production tested—and approved by many leading manufacturers of flexible edge grinding discs.

- Air cooled motor
- Safety trigger switch
- Lightweight magnesium housing
- Special hand grip for easier operation
- 110 or 220 AC or DC, 60 cycles or less as specified.

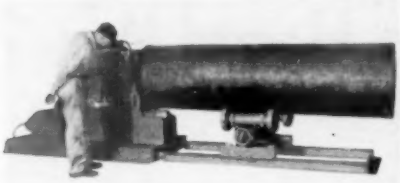
Write today for descriptive literature

THE *Nedco* COMPANY
88 Rumford Ave. • Waltham 54, Mass.

Circle No. 56 on Reader Service Card.

automatic welds and facilitates assembly of parts.

New style turn table permits rotation of the work, also permitting rotation of



work end to end and movement of work into and out of machine by means of the car type turntable with built in rails and wheels.

Circle No. 143 on Reader Service Card.

CIRCLE NUMBERS ON THE CARD AND MAIL!

Aluminum Welding Rod For Torch Or Carbon Arc

A new specially coated welding rod for both carbon arc and torch welding aluminum has been announced by the All-State Welding Alloys Co., Inc. Rod is designed for work on aluminum types 3S, 14S, 43S, 52S, 53S and 61S, and company engineers state that it increases speed of application, without sacrificing physical properties; gives sound, porosity free welds with good appearance; less distortion of work; flexibility in choice of carbon arc or torch. Rod is being marketed as All State No. 35 F.C.

Circle No. 144 on Reader Service Card.

Circle No. 58 on Reader Service Card.

NO SPECIAL WELDING TECHNIQUES NEEDED

with

MANGANAL

U.S. Patents 1,876,738—1,947,167—2,021,945

FLO-KOTE

11% - 13½% MANGANESE-NICKEL STEEL AC-DC WELDING ELECTRODES

- Runs as easily as stainless or mild steel electrodes.
- Not a composite rod. Alloys in rod, not in coating.

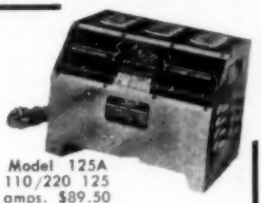
Nearest Distributor Upon Request

STULZ-SICKLES CO.

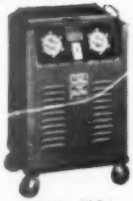
SOLE PRODUCERS

92 N. J. Railroad Ave. Newark, N. J.

AMERICA'S BIGGEST ARC-WELDER VALUES



Model 125A
110/220 125 amps. $89.50 complete.



Model 400A
220/440 400 amps. continuous $370.00 complete.

The preferred welder by those who know welding at its best. Designed and manufactured by specialists. Advanced engineering assures continuous production service eliminating work stoppage. No moving parts to wear—low operating cost—8 INDUSTRIAL MODELS range from 80 to 400 amps. Ruggedly built to meet the demands of industry.

Trindl
IRON TESTED ARC WELDERS

Trindl Products, LTD.

1807-11 S. Clark Street
CHICAGO 16, ILLINOIS

Circle No. 57 on Reader Service Card.

Do You Buy Tungsten Electrodes the Old Cracker-Barrel Way?

For Quality, Convenience and dependability, choose SYLVANIA PACKAGED ELECTRODES

Why pick electrodes by the old hit or miss method? Insist on Sylvania *Packaged* Tungsten Electrodes!

This up-to-date packaging eliminates the risk of using the wrong type. You'll find the exact Sylvania rod you need for any inert gas welding job . . . plainly indicated on every Sylvania carton.

Sylvania's sturdy black and yellow cartons also help reduce damage losses and permit an easy check on warehouse stocks.

Remember Sylvania, leader in the development of tungsten in many forms, controls the quality of its tungsten electrodes from ore to finished products, thus assuring uniformity and finest performance.

Now, the complete line of Sylvania Tungsten Electrodes is yours at *new low prices*. For full information concerning the real money savings these electrodes now mean, call your Sylvania Welding Distributor or write to Dept. 4T-1803, Sylvania TODAY!

SYLVANIA

Sylvania Electric Products Inc., 1740 Broadway, New York 19, N. Y.

In Canada: Sylvania Electric (Canada) Ltd., University Tower Bldg., Montreal, P. Q.

LIGHTING · RADIO · ELECTRONICS · TELEVISION

Circle No. 59 on Reader Service Card.

Inert arc welding and special alloy hard facing rod are used to rebuild rubber machinery screws. Besides eliminating the need for scrapping worn parts, hard facing reduces maintenance and increases life of part by four times.

Inert Arc Hard Facing Saves $4,000 in Rebuilding Extrusion Screws

EXTRUSION screws for rubber machinery are being reclaimed at a fraction of their original cost by Hard Face Welding and Machine Co., Buffalo, N. Y. Worn screws are rebuilt using the inert arc welding process and a special alloy hard facing rod. When rebuilt, screws give four to six times the life of new equipment.

The large screws are used to process scrap rubber in a reclaiming machine at U. S. Rubber Reclaiming Co. in Buffalo. The machine completes an operation that had previously taken an entire day, in less than one-half hour. It also permits the Company to produce reclaimed rubber in powdered form rather than in conventional slabs. In operation the flights force the rubber through a die from which it emerges as devulcanized rubber. The screws weigh about 3½ pounds. They are about a foot in diameter and 14½ feet long. New ones cost between six and seven thousand dollars.

Now the parts are being reclaimed at about one-quarter of

Circle No. 60 on Reader Service Card.

Notch
12
PIPE ENDS
PER MINUTE
Make Perfect Joints
for Welding or Brazing
ARC-FIT
NOTCHES CLEAN
NO FINISHING
Standard ARC-FIT in hand or power press shears contours for "T" joints for ½" to 2" pipe or tubing with easily interchanged dies.
Special ARC-FITS for larger sizes, angles other than 90°, slotting or notching square pipes, angle iron or flat stock.
Standard Arc-Fit works well in our special HAND PRESS
Send for descriptive bulletin
VOGEL TOOL & DIE CORPORATION
1819 N. 32nd AVE. • MELROSE PARK, ILL.

this cost. They are hard faced on the forcing flights with Haynes Stellite Alloy No. 1 rod to bring them back to size. The amount of deposit necessary after finishing varies from 0.020 to ⅛-inch. Screws are ground to finish dimensions on the same lathe on which they were hard faced.

Eutectic Appoints Roehll Vice-President

Fred F. Roehll, national sales manager of the Eutectic Welding Alloys Corp., has been named vice-president in charge of sales, according to a recent announcement by Rene D. Wasserman, president.

Mr. Roehll, who has been in sales and sales management for many years, will continue to make his headquarters at the corporation's office at Flushing, N.Y.

WELDING HANDBOOK

THIRD EDITION

Now Ready . . . the largest collection of up-to-the minute welding information . . . vital facts covering fundamentals and applications of welding. Here's practical information on design, cost, inspection and quality control which you can adapt for your own use.

Price per copy in the U. S. and Canada, $12.00 —elsewhere $13.00.

Order your copy now through . . .

INDUSTRY AND WELDING

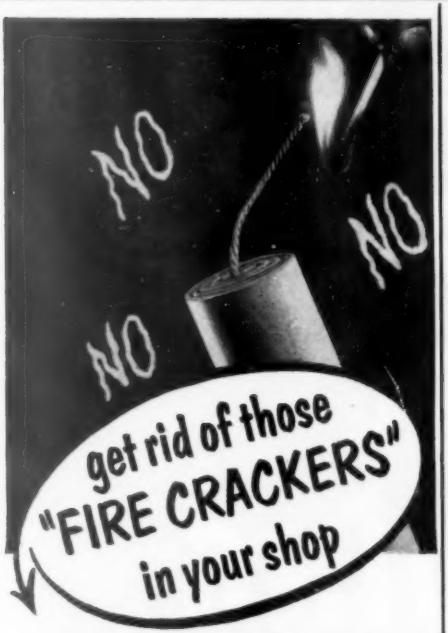
1240 Ontario Street Cleveland 13, Ohio

Zirtung Distributors

The following firms have been announced as distributors of Sylvania Electric Product Co.'s tungsten electrode, Zirtung. Further names will be added as received.

Texas: Fort Worth: Industrial Welding Supply Co.; Houston: Acme Welding Supply, Inc.; Victoria: Welders Equipment Co.

Virginia — Richmond: Welders Supply Co. of Richmond; Roanoke: Jones Welding Supplies; Washington — Spokane: Gibson Welding Supplies; Spokane Welder Supply Co.; Spokane Oxygen Service; Tacoma: Oxygen Sales & Service Co.; West Virginia—Charleston: Virginia Welding Co.; Wisconsin—Kenosha: H. R. Kelsey Welding & Engineering Co.; Madison: Badger Welding Supplies; Richard E. Ela Co.; Red Arrow Sales Corp.; Milwaukee: Acme Welding Supply, Inc.; Bentley Sales Co.



What fire crackers? We mean those welding and cutting torches that keep popping—back-firing—burning out valve seats. Did you know that the ingenious new Smith "FLO-TROL" prevents reverse flow of acetylene—protects torch against backfire and burned out seats?

Write us a card . . . NOW!

SMITH WELDING EQUIPMENT CORPORATION

Dept. IW-82, 2633 S.E. 4th St., Minneapolis, Minn.

Circle No. 61 on Reader Service Card.

WAGNER
ELECTRODE HOLDERS

mean

— Engineering at its Best!

— Dependability, Economy, Safety!

- "STREAMLINE" — Low center of gravity trigger for quick one-hand rod release — saving time in production WELDING.
- HIGH HEAT RESISTANCE — Glass fiber insulation for Jaw covers give greater strength with longer life.
- WAGNERLOY — High Arc Resistant copper alloy used in tong members.
- CHANNEL CONSTRUCTION — In tong members for more rapid heat dissipation.
- SPRING TENSION ADJUSTMENT — for proper rod grip and ease of spring replacement.

WAGNER MFG. CO.

350 W. 1st SOUTH ST.
JACKSON, MISSOURI

Weld with Wagner

Circle No. 62 on Reader Service Card.

Here's A

POCKET MANUAL OF

ARC WELDING

New Book You Should Have

YOU CAN USE IT EVERY DAY - - - an easy to read reference book, the POCKET MANUAL OF ARC WELDING provides practical on-the-spot information on many arc welding probems. Written from the standpoint of the welding supervisor and operator, it fills a long time need in the industry.

JUST OFF THE PRESS— the new POCKET MANUAL OF ARC WELDING contains the very latest data of interest and value to welding supervisors, foremen, inspectors and operators. It boils down into one concise easy-to-use book—172 pages of necessary practical working information you'll use every day in your shop work.

CALL YOUR LOCAL WELDING SUPPLY DISTRIBUTOR— for copies. If he cannot supply you, attach check or money order to the coupon below and mail it now. Pocket size: 5 x 7¾. Soft canvas bound cover. Single copies are $1.00. Special discounts to schools, libraries and dealers in quantities of 25 or more.

172 Interesting Pages

Written by Lew Gilbert, Editor of INDUSTRY and WELDING this "down-to-earth" Pocket Manual can be used as a welding department guide as well as a text book for operator training programs. It contains a large variety of new reference data in the form of charts, diagrams, welding symbols, efficient joint details, etc.

The Industrial Book Co.
1240 Ontario St.
Cleveland 13, Ohio

Please send me.....copies of the (POCKET MANUAL OF ARC WELDING) at $1.00 each. Check or money-order in the amount of $..... is attached.

Name .....

Address .....

City and State .....

INDUSTRY • WELDING NEWS

Schilling Upped At Marquette Mfg. Co.

As a part of a more intensive sales and promotion program for the Marquette Mfg. Co.'s welding

equipment, Walter G. Schilling, formerly assistant sales manager, has been promoted to sales manager of the company's welding division.

Black & Decker Erects $2,000,000 Addition

A $2,000,000 addition to the Hampstead, Md. branch plant of the Black & Decker Mfg. Co. has been erected and production operations have started, according to a recent announcement by Alonzo G. Decker, president. This new addition, covering 126,000 square feet, more than doubles the size of the original plant.

Archer Issues New Publication

The prime purpose of a new house organ issued by the Fred C.

Archer Co. is to familiarize shop men, management and dealers with the necessity of stabilizing the moisture of stainless steel and low hydrogen electrodes. This and similar related welding problems are discuss in the new publication called "Welding Supply Views." The first issue announces a $100 prize for the best letter on the use of the Archer Co.'s Aridair Stabilizer.

Inco Sales Appointments

The International Nickel Co. recently announced three new appointments in the company's sales department.

J. M. Weldon has been transferred to the Central Sales Department as assistant to the vice-president. C. J. Bianowicz has been named manager of the Inco Nickel Alloys Department and Daniel W. Machon has been placed in charge of the Cobalt Section of the Nickel Sales Department.

Every Time you use the button...

1. You save money by preventing the waste of Oxygen and Acetylene that occurs every second a torch flame burns yet is not actually applied to work.
2. You save time by eliminating constant lighting, flame adjusting and Torch shut off. This adds materially to output of work.
3. You make life easier for the torch operator. A single quarter-inch movement of the thumb accomplishes the same result as a dozen or more motions, involving both hands.
4. You bring your operations up-to-date by as big an improvement as that made when self starters were added to automobiles — more so, in fact, since the Harris Automatic Torch repays its entire cost many times over in cash savings.
5. When you next see a torch burning, without being applied to work, decide to DO something about it! Contact the nearest Harris Exclusive Distributor, located in principal Cities. Better yet, do it now.

THE HARRIS CALORIFIC COMPANY

Cleveland 2, Ohio

HARRIS

SERVING THE METAL INDUSTRY SINCE 1905

Circle No. 63 on Reader Service Card

A. O. Smith Makes Changes In Sales And Production Staff

Sales and production staff changes were recently announced by the Welding Products Div. of the A. O. Smith Corp.

Paul Mederich has been appointed manager of the Elkhorn, Wis. plant where all Smith welding machines are manufactured, and Ernst W. Kiewitt has been made manufacturing superintendent of the Elkhorn plant.

Sales staff appointments by regions are: Central Region: E. A. Steidl will now cover Welding Division sales for Southern Wisconsin and part of Milwaukee. Warren Ware will now cover Northern Wisconsin and the remaining half of Milwaukee. Eastern Region: M. A. Ockerman has assumed the territory at Canfield, Ohio, and R. H. Schradieck takes

THREE NEW GUIDES for METAL CUTTING

Now you can accurately, easily flame cut all kinds of shapes — circles, angles, bevels, straight lines. NEECO cutting guides convert ordinary hand torches into precision cutting instruments. Attached quickly — without tools. Neat, clean cuts need little or no grinding or machine finishing. Models to fit all torches, from 70° to 90° types. Cut circles from 1 to 66 inches diameter. Every shop should have these new guides — as basic, time saving tools or as standby equipment.

The new NEECO guides are of three types —for small circles (shown above), for large circles, and for straight lines.

Write for illustrated Bulletin 101 and model selection data.

NEECO Precision Flame Cutting — Fast and Exact!

NEW ERA ENGINEERING COMPANY
458 West 29th St., Chicago 16, Illinois
Circle No. 64 on Reader Service Card.

RE-GALVANIZE WITH Galvalloy COATING

Pre-Heating

Applying Galvalloy

WILL
- BOND QUICKLY
- BOND PERMANENTLY
- BOND TO MOST METALS
- WITHSTAND 30 DAY SALT SPRAY TEST

NO
- FLUX
- SANDBLASTING
- CLEANING

WON'T
- PEEL OFF
- BURN OFF
- CHIP OFF

Galvalloy costs you less, because of its higher melting temperature which eliminates loss in application.

METALLOY PRODUCTS CO.
1351 EAST 17TH ST., LOS ANGELES 21
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over the territory at Boston, Mass. Western Region: E. W. Olds has been appointed at Oakland, Calif. and will cover the Bay area, and Richard Terry will cover the Los Angeles area.

F. J. Connolly Appointed Pandjiris Regional Manager

Frank J. Connolly was recently appointed eastern regional manager for the Pandjiris Weldment Co. Mr. Connolly will be responsible for the sale of the firm's welding positioners, turning rolls, welding head manipulators and other equipment for the welding field.

Connolly, who has had wide experience in the application of positioning equipment to automatic and semi-automatic welding, will supervise sales throughout the East, including Ohio. His headquarters are in Plainfield, N.J.

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Pre-heating, which could cause an unpredictable amount of warpage in heavy plate, is not needed with the inert arc welding process because it produces concentrated heat rapidly. Here's how . . .

Automatic Inert Arc Welding Joins Heavy Aluminum Plate

by GILBERT C. CLOSE

THE HIGHLY localized and intense energy created by the inert gas shielded metal arc welding process is proving advantageous in many small job shops where conventional pre-heating facilities are either non-existent or of makeshift variety. In this welding process, heat is created so rapidly in the weld area that good fusion is obtained regardless of surrounding areas of cold metal. An added advantage is that preheat warpage that might occur in some types of work is entirely eliminated.

A striking illustration of these advantages occurred recently at Airline Engineering and Welding Company, Hawthorne, Calif. The job was to weld together four No. 356 alloy aluminum plate sections into a single critically-dimensioned suction hold down plate for an air-

craft tapered skin mill. Final dimensions of the plate were 1¾-inch thick, 21 feet long, 6 feet wide at one end and tapered to 3 feet wide at the other. With any other method of welding, pre-heating of the plate sections would have been mandatory, and a non-predictable amount of pre-heat warpage would have been certain to occur.

Using the inert-arc welding process made pre-heating unnecessary. Double Vee butt joints were used, with a single weld bead on both sides of the joint. About 12 pounds of aluminum welding rod in coiled form was used to make the welds. Critically straight steel I-beams were used to support the plate sections during welding and to keep them in accurate alignment.

The weld beads were then ground flush and the suction plate returned to the customer. The outstanding success of this welding operation was summed up in the customer's final report: "In machining this tool plate absolutely flat prior to installing in the skin mill, a single surface cut 0.040-inches in depth was all that was required!"

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FLUID POWER CIRCUITS

It's the first time that more than 80 air and hydraulic circuits drawn to JIC Standards have been published under one cover. This 32 page booklet will help you with design and maintenance problems of your fluid powered equipment. Here are some of the subjects covered:

Pump Unloading Methods
Pressure Regulating Circuits
Speed Control Circuits
Accumulator Applications
Sequencing Methods
Motion Synchronizing Circuits
Electrically Controlled Circuits
Locking Circuits

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1240 Ontario St.
Cleveland 13, Ohio
Please send me .... copy (ies) of "FLUID POWER CIRCUITS' at the price of 50 cents per copy. Check is enclosed.
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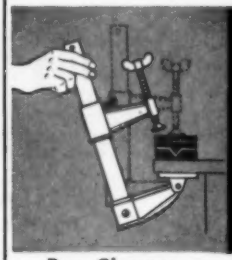
Company .....
Address .....
City ..... State .....



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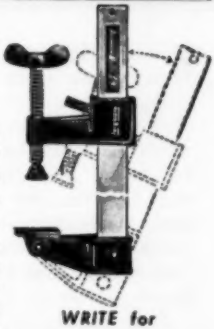

Mount on any flat surface . . . bench, saw horse, etc., to make instant acting clamping jigs or fixtures. Ideal for repeat operations. Clamps are fixed, always available when needed—but swing out of way when not in use. Also usable as regular bar clamp.

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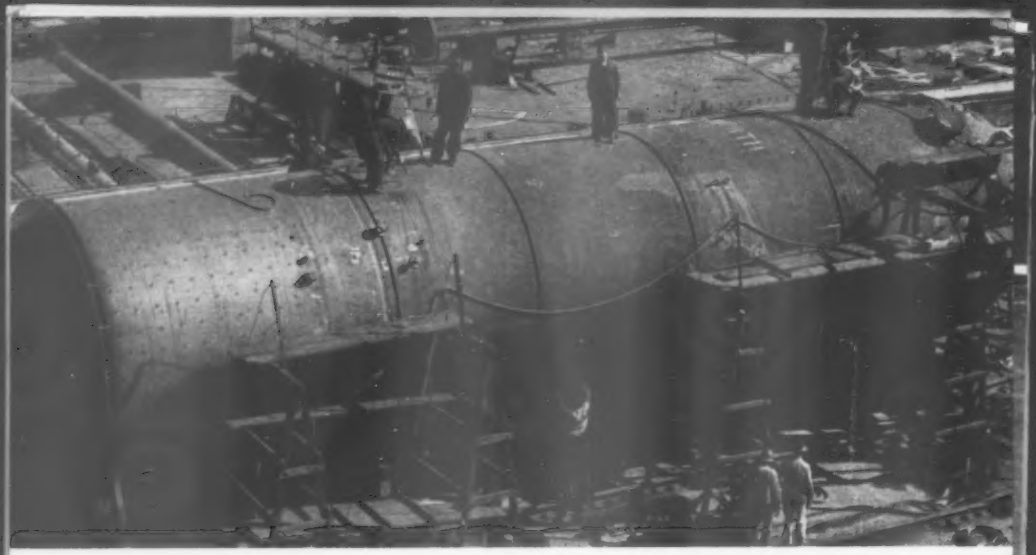


Shipyard Welding "Know-How" Pays Off in Industrial Fabrication

by RALPH H. QUIST
Robt. W. Hunt Co., Engineers.
San Francisco, Calif.

BECAUSE the shipbuilding industry has been experiencing its usual peace time slump, progressive shipbuilding companies have made efforts to offset this trend by doing general industrial welding fabrication for the chemical and petroleum industries. Shipyard welding experience, practice and equipment has proved to be of great value in this type of work.

Just recently, the San Francisco shipyard of Bethlehem-Pacific Coast Steel Corp. completed one of the largest stainless clad pressure vessels ever built on the West Coast. This vessel was designed by the Standard Oil Company of California for an oxidizing process at their new phenol plant in Richmond, Calif. It was built to API-ASTM code requirements and designed to operate at 122 psi and a temperature of 450°F.

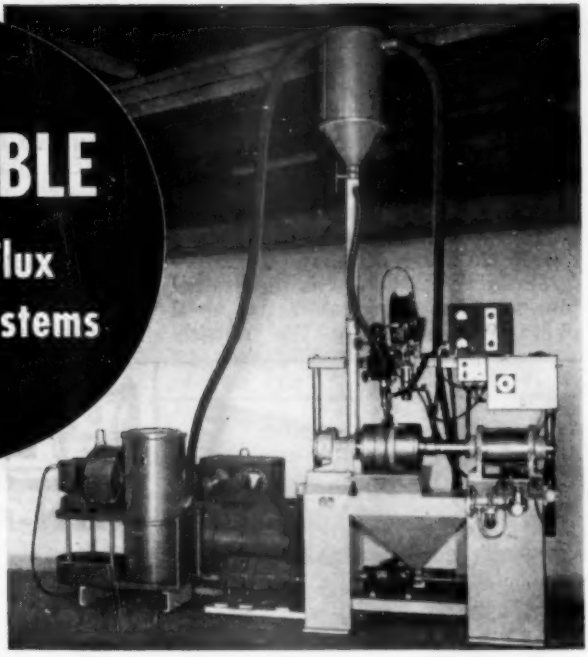
ABOUT THE PHOTO

This stainless clad pressure vessel, one of the largest ever built on the West Coast, was fabricated to API-ASTM code requirements by a San Francisco shipyard.

The huge vessel weighs 85 tons, is 65 feet high and 14 feet in diameter. It was fabricated from stainless clad plates measuring 10 feet by 22 feet. The shell plating is $\frac{15}{16}$-inch thick with $\frac{1}{16}$-inch of cladding. Hemispherical heads are $\frac{9}{16}$-inch thick of which $\frac{1}{16}$-inch is cladding. Approximately 2000 feet

INVINCIBLE

Welding Flux Recovery Systems



This compact set-up includes a primary separator tank and an Invincible Model 460 unit.

Pay for themselves . . . with interest!

If you have a submerged arc welding job, consider these benefits:

1. Invincibles save valuable flux by recovering **all** loose flux from the work, removing slag or fused particles, and returning the unfused flux to the hopper of the welder. Both manual and continuous flow systems are available.

2. Invincibles save costly man-hours because they are more rapid and efficient than manual methods.

3. Invincibles also save money by removing all fine dust (flux flour), thus speeding production and reducing welding rejects.

These Invincible advantages can be applied to your job, regardless of its size. Let us send you our **Free Folder** on Flux Recovery.

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DOVER, OHIO

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of 2-inch diameter Type 304 stainless steel tubing are formed into 8 heating coils. These were formed cold, welded with Type 347 stainless steel electrodes and then heat treated at 1550°F for two hours.

There are eight types of stainless steel used in the vessel. All welds that will be in contact with the corrosive fluid were made with Type 347 welding wire in order to minimize susceptibility to intergranular corrosion. Stainless steel nozzles that penetrated the shell were completed on the outside with Type 310 stainless steel electrodes, containing 25 percent chrome and 20 percent nickel. This higher alloy was used in order to prevent cracking by maintaining more austenite in the weld metal.

Minimize Iron Dilution

Baffle plates of Type 410 stainless steel divide the vessel into four pie-shaped segments, or stages. These baffles were bolted to Type 304 extra low carbon stainless steel bars that were welded to the vessel wall. The cladding had to be chipped away

Remove Weld Scale...
Weld Spatter Faster
with this
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Fits securely into operator's hand. By varying finger pressure on the exclusive metering trigger you can produce from 0 to 9000 blows per minute. Consumes 6.5 C.F.M. of air at 150 p.s.i. working pressure.
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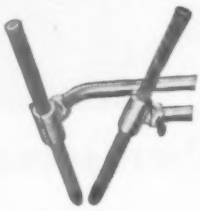

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the full length of the shell so that the bars could be welded to the backing steel. Two passes of stainless steel were required to minimize iron dilution in the completed welds.

The shell was assembled and welded in the vertical position. Baffle plates were placed in the shell from the top, using a 50-ton traveling crane. The vessel was then lowered to the horizontal position for fitting of heating coils and heads.

Victor Equipment Expands

L. W. Stettner, president of the Victor Equipment Co., recently announced that Victor has acquired a substantial interest in J. C. Menzies & Co. of Chicago. Menzies has for 25 years specialized in the distribution of welding products, hard facing rods and application engineering.

Victor has also acquired the outstanding stock of the Adams Alloy Co. and is now negotiating for a tract of land in Los Angeles to handle future expansion of its alloy rod and metal division.

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For Cast or Malleable Iron

No. 2—BRAZING COMPOUND
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No. 4—ALUMINUM FLUX
For Cast or Sheet Aluminum

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THE CHICAGO HARDWARE FOUNDRY CO.
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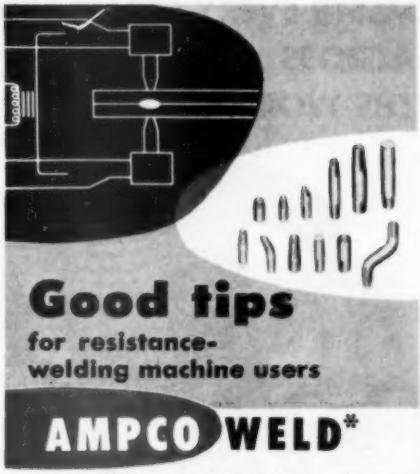

Good tips
for resistance-welding machine users

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spot-welding tips cut costs, downtime; increase production

Ampco Weld spot-welding tips are manufactured under rigid laboratory control. They resist mushrooming and wear and their high electrical conductivity minimizes sticking to the work.

These properties result in a resistance-welding electrode that needs fewer dressings and pays off in longer runs, reduced downtime. Step up your production — order Ampco Weld resistance-welding tips now.

*Reg. U. S. Pat. Off., Ampco Metal, Inc.

RW-5A

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West Coast Plant:
Burbank, California

It's production-wise to Ampco-ize!

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Destaco Appoints Purchasing Agent

John M. Thullen was recently appointed purchasing agent for all industrial raw material, production parts, services, finished stores and general factory supplies of the Detroit Stamping Co., according to Glendon H. Roberts, president and general manager.

NCG Announces Corporate Changes

The National Cylinder Gas Co. recently announced a simplification in its corporate structure.

Tube Turns, Inc., manufacturer of welding fittings and forgings, has become the Tube Turns division. The Pennsylvania Corp. of Philadelphia has become a division known as the Pennsylvania Forge Co. The Hollup Corp. of Chicago and the National Cylinder Gas Co., Pacific Coast, have been dissolved.

All officers of the two former corporations have been re-elected to the same offices of the new companies.

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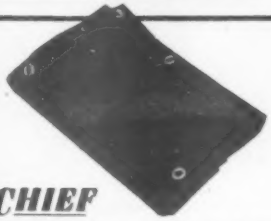

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POSITION WANTED

Executive potential, age 33; 12 years experience, shipbuilding, pressure vessel, power plant equipment fields as Welding Engineer. Desires supervisory or top level staff position.
Write Box 3154, INDUSTRY AND WELDING Magazine, 1240 Ontario St., Cleveland 13, Ohio.

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This definitely is a bigger opportunity than one which would have you start at the bottom. Yet from this Regional Sales Managership, you still can write a further ticket for advancement. Hence, man selected by this national concern must have prior experience in management to take care of several states in which distribution is established, and be capable of demonstrating and selling WELDING ALLOYS. Reply in confidence giving full experience and educational background accompanied by picture. Interview to follow. ALL OUR PEOPLE KNOW OF THIS ADVERTISEMENT.
Write Box 3254, INDUSTRY AND WELDING Magazine, 1240 Ontario St., Cleveland 13, Ohio.

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NEW! ARCAIR MODEL J-5 HEAVY DUTY TORCH . . .

The Arcair Model "J-5" is a rugged, heavy duty torch for gouging and cutting all metals, using only electric arc and compressed air.

Low in original cost and low in maintenance cost, the "J-5" is a special, simplified Arcair model for foundries and other production-line operations . . . removing excess metal, gouging out cracks and removing defective welds.

Complete with two interchangeable heads for ½" and ⅜" electrodes..... $69.50

Write for free bulletin with facts and photographs of time and money-saving applications of the Arcair Torch. **Arcair Company:** EASTERN DIVISION, P. O. Box 337, Lancaster, Ohio; WESTERN DIVISION, P. O. Box 4107, Bremerton, Wash.

Arcair TORCH

Cuts all metals—using only electric arc and compressed air

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LESS APT TO BURN—The blade slips back into the case, away from torches.

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Mesh-Belt Brazing Furnace Reduces

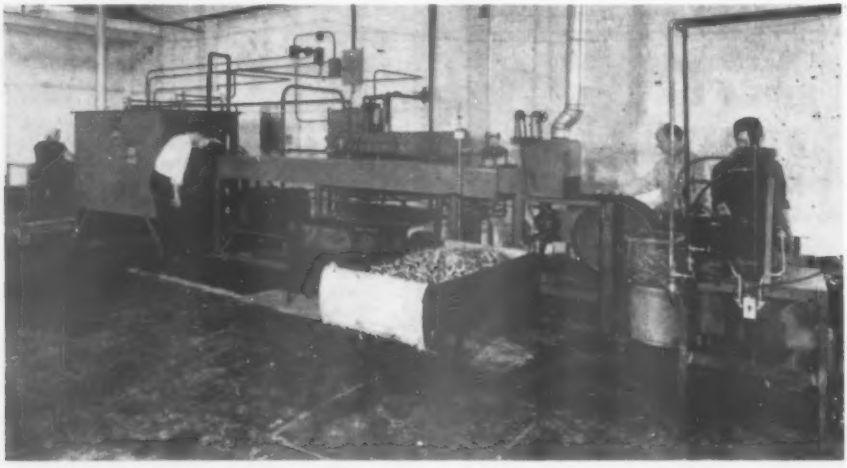
Brazing material is applied to refrigerator mufflers before stamped parts are loaded in alloy mesh conveyor belt which passes through the furnace.

SPEEDS and costs are vital considerations for the Acklin Stamping Co., Inc., of Toledo, Ohio. A 100 percent job shop, Acklin specializes in manufacture of stamped parts to customers' specifications and serves manufacturers of household appliance, agricultural and automotive products.

Brazed Assembly Costs 3 Cents

In 1950, Acklin installed a small General Electric mesh-belt brazing furnace, realizing that efficient, low-cost operation could greatly increase their volume of business. Prior to that, no brazing was done, but now a complete stamping and brazing operation can be accomplished. For examples, Acklin reduced costs 87 percent by copper-brazing a refrigerator muffler assembly. It cost them only three cents to braze the assembly using the controlled atmosphere copper brazing furnace, compared to an

Overall view of the 45-kw mesh-belt copper brazing furnace in use. Additional installation is contemplated in adjacent area.



Production Costs by 87 Percent

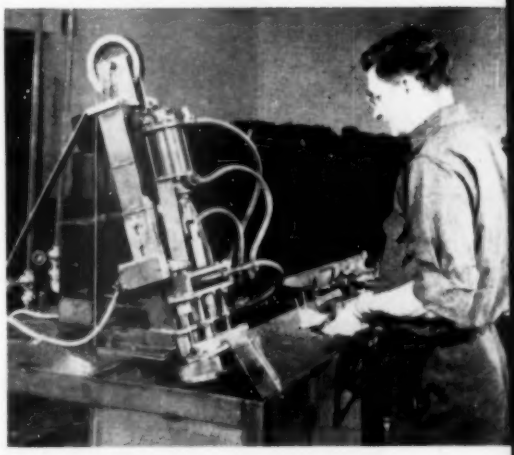
estimate cost of 24 cents for manual arc welding.

Weight is very important in the industries Acklin serves and brazing results in marked weight reductions.

Operates 16 Hours A Day

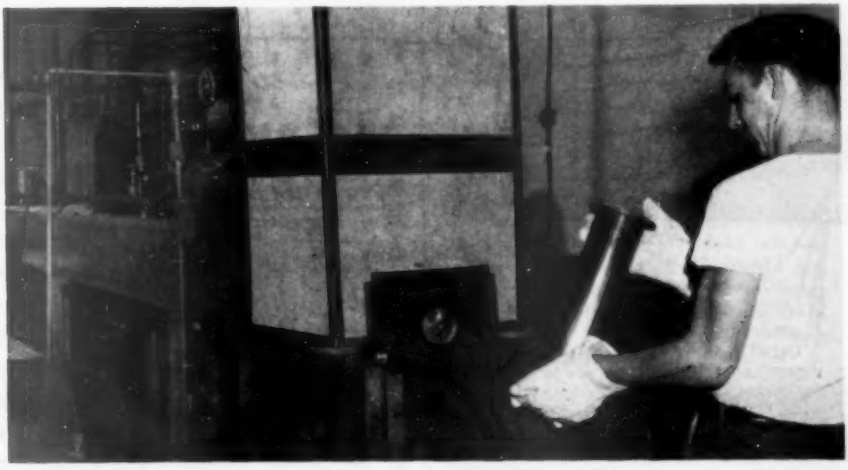
Since installing the mesh-belt furnace, the company has had to replace only three elements and two belts with a total down time of less than 40 hours. The furnace operates 16 hours a day, five days a week. It is rated at 300 pounds gross per hour, and at present the company is getting 325 pounds gross per hour. Production rates include 750 pieces per hour on pistons and 700 pieces per hour on mufflers.

For additional information write to Editor, INDUSTRY and WELDING Magazine, 1240 Ontario St., Cleveland 13, Ohio, or Circle No. 201 on Reader Service Card.



Refrigeration mufflers are air-tested at 200 psi after they emerge from brazing furnace.

Brazed piece of Temprite used as refrigerator part is removed from end of brazing furnace by operator.



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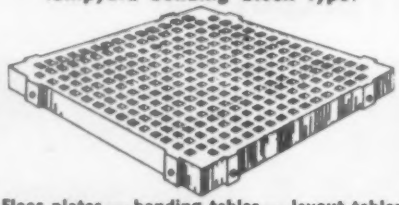
WELDING and SET-UP PLATENS
(Shipyard bending block type)



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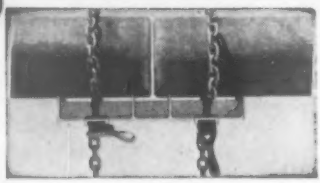

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- Threads never exposed
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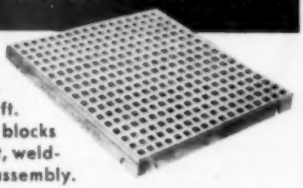

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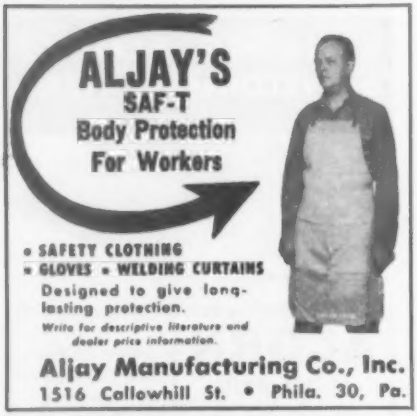

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